

ภาคผนวก จ

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	RYG_FS0176	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0180	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0174	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0292	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	20-Feb-25	20-Feb-26	12
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0251	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0271	1-Jul-25	1-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	RYG_FS0263	2-Jul-25	2-Jan-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS0796	1-Jul-25	1-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0252	1-Jul-25	1-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0272	2-Jul-25	2-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	RYG_FS0264	2-Jul-25	2-Jan-26	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	BKK_FS0797	2-Jul-25	2-Jan-26	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0085	15-Jan-25	15-Jul-26	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0496	19-Mar-25	19-Mar-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0491	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0492	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0493	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0494	27-Jan-25	26-Jan-26	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0495	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0027	1-Oct-24	1-Oct-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0492	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0493	27-Jan-25	26-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0069	1-Jul-25	1-Jul-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0614	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0615	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0616	23-Dec-24	23-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0618	21-Jan-25	20-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0118	3-Dec-24	3-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0119	3-Dec-24	3-Dec-25	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0622	21-Jan-25	21-Jan-26	12
Noise	Leq 8 hrs	Sound Calibrator	RYG_FS0213	16-Jan-25	16-Jan-26	12
Noise	Leq 8 hrs	Sound Level Meter	RYG_FS0017	27-Jan-25	27-Jan-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0210	12-Feb-25	11-Feb-26	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0635	26-May-25	25-May-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0042	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0645	28-Apr-25	27-Apr-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0033	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0034	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0037	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0040	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0047	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0638	27-Sep-24	27-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0639	2-Oct-24	2-Oct-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0039	17-Sep-24	17-Sep-25	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0045	11-Sep-24	11-Sep-25	12
Noise	Noise Dose, TWA	Dose Badge Reader	RYG_FS0635	26-May-25	25-May-26	12
Noise	Noise Dose, TWA	Dosimeter	RYG_FS0641	27-Sep-24	27-Sep-25	12
Workplace	Hydrochloric Acid / Total Dust /	DRYCAL FLOWMETER	RYG_FS0208	27-Jan-25	26-Jan-26	12
Workplace	Respirable Dust /	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Workplace	Copper (Fume) / Iron (Fume) /	Air Sampling Pump	RYG_FS0366	6-Oct-25	6-Jan-26	3
Workplace	Zinc (Inhalable dust)	Air Sampling Pump	RYG_FS0689	3-Oct-25	3-Jan-26	3
Workplace		Air Sampling Pump	RYG_FS0672	2-Oct-25	2-Jan-26	3
Workplace		Air Sampling Pump	RYG_FS0111	7-Oct-25	7-Jan-26	3
Workplace		Air Sampling Pump	RYG_FS0739	2-Oct-25	2-Jan-26	3
Workplace		Air Sampling Pump	RYG_FS0165	7-Oct-25	7-Jan-26	3



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

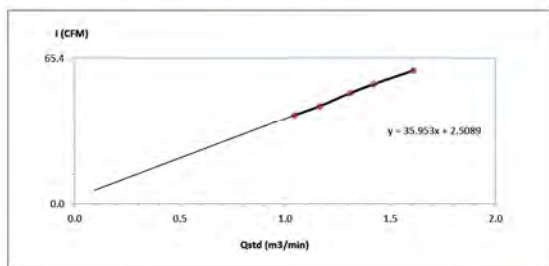
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Workplace	Hydrochloric Acid	Ion Chromatography	BKK_EN0427	21-Nov-24	21-Nov-25	12
Workplace	Total Dust	Digital Balance	RYG_EN0004	20-Feb-25	20-Feb-26	12
Workplace	Respirable Dust	Digital Balance	RYG_EN0004	20-Feb-25	20-Feb-26	12
Workplace	Copper (Fume)	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Workplace	Iron (Fume)	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Workplace	Zinc (Inhalable dust)	ICP-OES	BKK_EL0037	23-Sep-24	23-Mar-26	18
Illuminance	Illuminance	Lux Meter	RYG_FS0474	13-Mar-25	12-Mar-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0578	13-Aug-25	12-Aug-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0580	14-Aug-25	13-Aug-26	12
Heat	Heat Stress	Heat Stress Monitor	RYG_FS0581	14-Aug-25	13-Aug-26	12
Rayong Lab	pH at 25 °C	pH Meter	RYG_EN0152	18-Jun-25	18-Dec-26	18
Rayong Lab	BOD	DO meter with Sensor	RYG_EN0032	20-Jan-25	20-Jul-26	18
Rayong Lab	BOD	Incubator	RYG_EN0154	1-Nov-24	1-May-26	18
Rayong Lab	BOD	Burette	RYG_EN0216	18-Sep-25	18-Sep-26	12
Rayong Lab	COD	Spectrophotometer	RYG_EN0037	18-Mar-25	18-Sep-26	18
Rayong Lab	Total Suspended Solids	Electronic Balance	RYG_EN0163	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Suspended Solids	Chamber (Oven)	RYG_EN0012	10-Sep-25	10-Mar-27	18
Rayong Lab	Total Dissolved Solids 180°C	Electronic Balance	RYG_EN0163	20-Feb-25	20-Feb-26	12
Rayong Lab	Total Dissolved Solids 180°C	Chamber (Oven)	RYG_EN0012	10-Sep-25	10-Mar-27	18
Rayong Lab	Oil & Grease	Electronic Balance	RYG_EN0003	20-Feb-25	20-Feb-26	12
Rayong Lab	Oil & Grease	Liquid Bath (Water)	RYG_EN0220	19-Dec-24	19-Dec-25	12
Rayong Lab	Temperature	pH meter	RYG_FS0606	25-Aug-25	25-Aug-26	12



High Volume Air Sampler Calibration Worksheet

Project Site: Bridgestone Metalpla(Thailand) Co., Ltd.
Calibrate Location: โรงผลิตรถยนต์ (A3)
Calibrate Date: 29-Aug-25
CalibrationSheet No.: C-290825-RYG-FS0176
Calibrator ID: RYG_FS0206
Calibrator Model: TE-S028A
Calibrator S/N: 1543
Barometric Pressure (mm Hg): 744.7
Temperature (°C): 32.9
High Volume ID: RYG-FS0176
High Volume Model: TE-S170D
High Volume S/N: 4802
Calibrator Slope: 1.48469
Calibrator Intercept: -0.02523

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.4	1.0447	40	Slope: 35.9532 Intercept: 2.5089 Correlation Coefficient: 0.9986
2	3.0	1.1650	44	
3	3.8	1.3080	50	
4	4.5	1.4212	54	
5	5.8	1.6100	60	



Calibrated by:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)

Approved by:
(Mr. Supot Salamteh)
Field Services Section Head

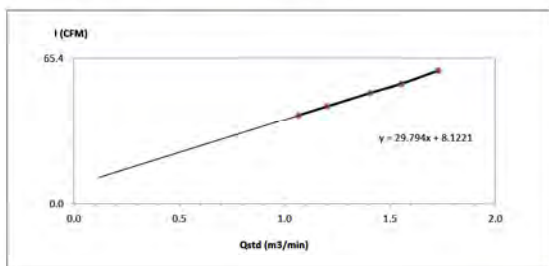
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Bridgestone Metalpla(Thailand) Co., Ltd.
Calibrate Location: พื้นที่โรงงาน (A1)
Calibrate Date: 29-Aug-25
CalibrationSheet No.: C-290825-RYG-FS0180
Calibrator ID: RYG_FS0206
Calibrator Model: TE-S028A
Calibrator S/N: 1543
Barometric Pressure (mm Hg): 750.0
Temperature (°C): 34.7
High Volume ID: RYG-FS0180
High Volume Model: TE-S170D
High Volume S/N: 1328
Calibrator Slope: 1.48469
Calibrator Intercept: -0.02523

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.5	1.0663	40	Slope: 29.7937 Intercept: 8.1221 Correlation Coefficient: 0.9993
2	3.2	1.2031	44	
3	4.4	1.4064	50	
4	5.4	1.5554	54	
5	6.7	1.7296	60	



Calibrated by:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)

Approved by:
(Mr. Supot Salamteh)
Field Services Section Head

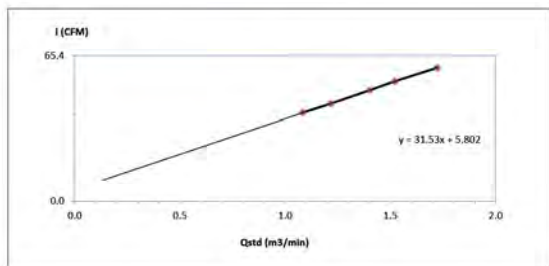
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High Volume Air Sampler Calibration Worksheet

Project Site: Bridgestone Metalpla(Thailand) Co., Ltd.
Calibrate Location: โรงผลิตรถยนต์ (โรงงานประกอบรถบรรทุก 250 มตร) (A2)
Calibrate Date: 29-Aug-25
CalibrationSheet No.: C-290825-RYG-FS0174
Calibrator ID: RYG_FS0206
Calibrator Model: TE-S028A
Calibrator S/N: 1543
Barometric Pressure (mm Hg): 750.9
Temperature (°C): 37.4
High Volume ID: RYG-FS0174
High Volume Model: TE-S170D
High Volume S/N: 4800
Calibrator Slope: 1.48469
Calibrator Intercept: -0.02523

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0830	40	Slope: 31.5303 Intercept: 5.8020 Correlation Coefficient: 0.9998
2	3.3	1.2169	44	
3	4.4	1.4012	50	
4	5.2	1.5211	54	
5	6.7	1.7232	60	



Calibrated by:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)

Approved by:
(Mr. Supot Salamteh)
Field Services Section Head

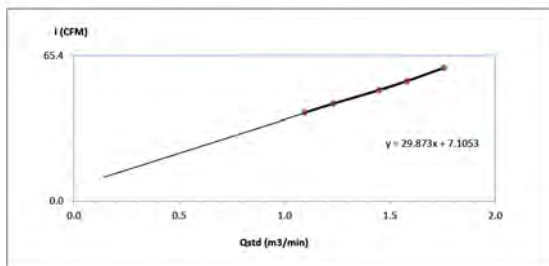
FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



High Volume Air Sampler Calibration Worksheet

Project Site: Bridgestone Metalpla(Thailand) Co., Ltd.
Calibrate Location: บ้านครัวใหม่ (A4)
Calibrate Date: 29-Aug-25
CalibrationSheet No.: C-290825-RYG-FS0292
Calibrator ID: RYG_FS0206
Calibrator Model: TE-S028A
Calibrator S/N: 1543
Barometric Pressure (mm Hg): 750.8
Temperature (°C): 30.2
High Volume ID: RYG-FS0292
High Volume Model: TE-S170D
High Volume S/N: 5497
Calibrator Slope: 1.48469
Calibrator Intercept: -0.02523

Test No.	Delta H ₂ O (inch)	Q _{ad} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.6	1.0954	40	Slope: 29.8732 Intercept: 7.1053 Correlation Coefficient: 0.9996
2	3.3	1.2309	44	
3	4.0	1.4407	50	
4	5.5	1.5817	54	
5	6.8	1.7559	60	



Calibrated by:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)

Approved by:
(Mr. Supot Salamteh)
Field Services Section Head

FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23



Calibration certificate

Calibration Certificate No. 25BKL0001

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	LA130S-F	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Mifitcod) SOP W108.
Serial QM Ident. no.	25409664 RYG_EN0001	This certificate relates and applies this equipment only.
Customer	ALG Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	616/10 Moo 5 T.MaeNam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Thanitak*
APPROVED BY *Dharmas*
NEXT CAL DATE 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		<i>Chonchai Inthana</i>	<i>Kachen Laee</i>
		Mr. Chonchai Inthana	Kachen Laee

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

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Calibration certificate No.: 25BKL0001
Calibration Certificate

Calibration object

Single range instrument

Model	LA130S-F
Serial Number	25409664
QM Ident. no Inventory no.	RYG_EN0001 --

Maximum capacity (Max. load)	150.0000 g
Measured range	150.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Laboratory Department --
Building Floor	-- 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHS-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

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10310 Bangkok

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Calibration certificate No.: 25BKL0001
Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration Temp. diff.	24.5 °C 1.0 K
Weights - Trace	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 58.0 %RH.

Measurement results | Measurement uncertainties

Repeatability		Eccentricity	
Test load (nominal): 10 g 100 g		Test load (nominal): 50 g	
10 g	100 g	Center	50.0000 g
1	10.0000 g	Front left	50.0001 g
2	9.9999 g	Back left	50.0000 g
3	10.0000 g	Back right	49.9999 g
4	10.0000 g	Front right	50.0001 g
5	10.0000 g	Maximum deviation from centric loading indication:	
6	9.9999 g	ΔMax = 0.0001 g	
7	10.0000 g		
8	10.0000 g		
9	10.0000 g		
10	10.0000 g		
s = 0.00004 g σ = 0.00005 g			

Error of indication		Expansion factor		Uncertainty		Uncertainty relative	
Testload L	Indication I	Error E	Expansion factor k	Uncertainty U(E)	Uncertainty Urel(E)	Uncertainty Urel(E)	Uncertainty Urel(E)
0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %		
0.0500 g	0.0500 g	0.0000 g	2.00	0.00013 g	0.25 %		
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %		
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %		
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %		
2.0000 g	2.0000 g	0.0000 g	2.00	0.00013 g	0.0065 %		
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %		
10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %		
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00065 %		
100.0000 g	100.0000 g	0.0000 g	2.00	0.00021 g	0.00021 %		
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00028 g	0.00019 %		
Maximum error of indication		E_max = 0.0001 g					

Urel(E) is the quotient of U(E) and test load L. The uncertainty of measurement Urel(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under Appendix to the calibration certificate 1 Interpretation of measurement results.

Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented expansion factor, determined in accordance with the European Calibration Guidelines EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measured will be in the assigned value range.

End of calibration certificate

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Interpretation of measurement results | Appendix to the calibration certificate

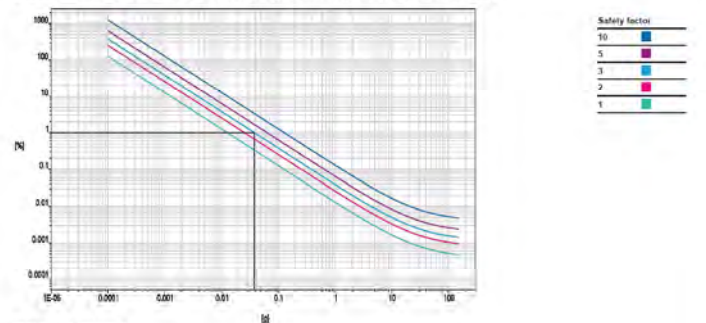
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁶ /K
Uncertainty of the weighing result U ₉₅ (W)	U ₉₅ (W) = 0.00013 g + 3.96 · 10 ⁻⁶ · R

Reference note: The current uncertainty of measurement is calculated by entering the reading R into the formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor of 2, determined in accordance with the European Calibration Guidelines EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measured will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty U ₉₅ (W)	Uncertainty relative U ₉₅ (W)/W _{rel}
1 %	1.5000 g	0.00014 g	0.0091 %
25 %	37.5000 g	0.00028 g	0.00074 %
50 %	75.0000 g	0.00043 g	0.00057 %
75 %	112.5000 g	0.00058 g	0.00051 %
100 %	150.0000 g	0.00072 g	0.00048 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0380 g

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129 Rama 9 Road, Huaykwang
10310 Bangkok

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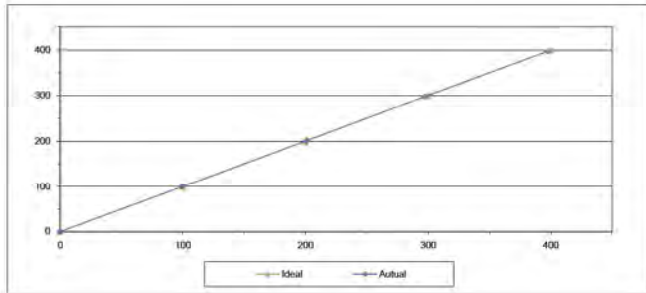
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MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25 Equipment Name SO2 Analyzer
 Manufacturer Teledyne API Model T100
 Serial No. 1773 Equipment ID RYG_FS0251
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.60	-0.40	-0.40
2	200.00	201.00	1.00	0.50
3	300.00	297.30	-2.70	-0.90
4	400.00	397.50	-2.50	-0.63
AVERAGE (%)				-0.27



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

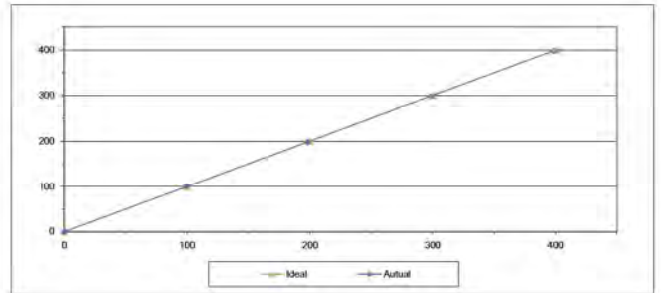
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-25 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. 1092NYKM Equipment ID RYG_FS0271
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.50	-0.50	-0.50
2	200.00	198.00	-2.00	-1.00
3	300.00	298.70	-1.30	-0.43
4	400.00	398.40	-1.60	-0.40
AVERAGE (%)				-0.45



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

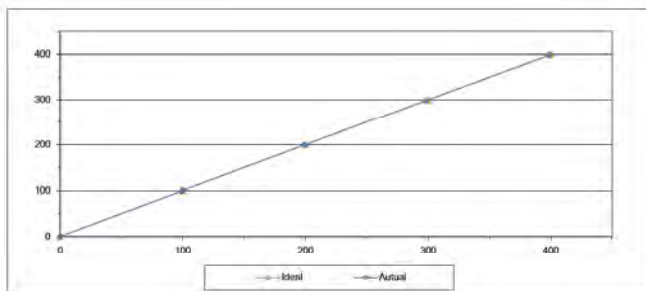
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. YPRXJJ20 Equipment ID RYG_FS0263
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30
2	200.00	199.40	-0.60	-0.30
3	300.00	298.20	-1.80	-0.60
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.30



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

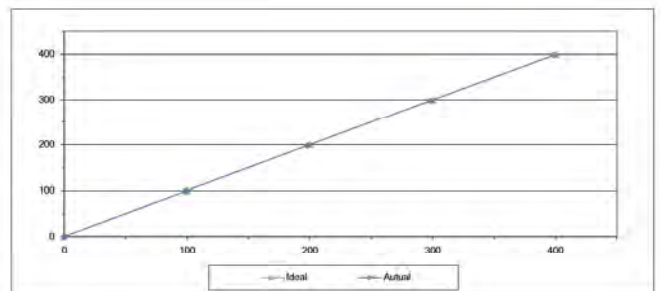
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-25 Equipment Name SO2 Analyzer
 Manufacturer HORIBA Model APSA-370
 Serial No. G2CH436B Equipment ID BKK_FS0796
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 56.3 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	98.70	-1.30	-1.30
2	200.00	198.10	-1.90	-0.95
3	300.00	298.30	-1.70	-0.57
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.63



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

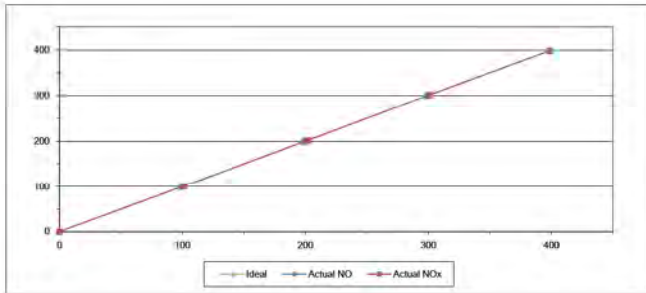
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 1-Jul-25 Equipment Name NOx Analyzer
 Manufacturer Teledyne API Model T200
 Serial No. 2198 Equipment ID RYG_FS0252
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	101.00	1.00	1.00
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	298.50	-1.50	-0.50	301.00	1.00	0.33
4	400.00	398.90	-1.10	-0.28	398.60	-1.40	-0.35
AVERAGE (%)				-0.58			0.35



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

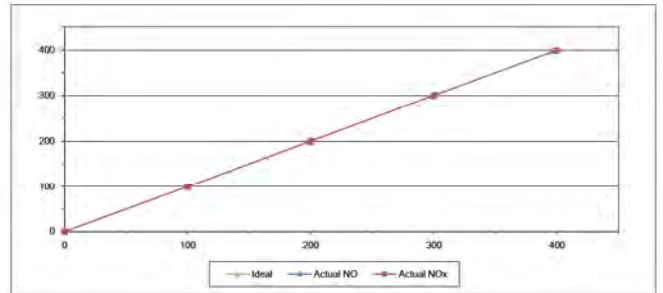
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. 7AV89544 Equipment ID RYG_FS0272
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.10	-0.90	-0.90	100.10	0.10	0.10
2	200.00	198.50	-1.50	-0.75	199.50	-0.50	-0.25
3	300.00	298.60	-1.40	-0.47	300.50	0.50	0.17
4	400.00	398.90	-1.10	-0.28	398.70	-1.30	-0.33
AVERAGE (%)				-0.47			-0.04



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

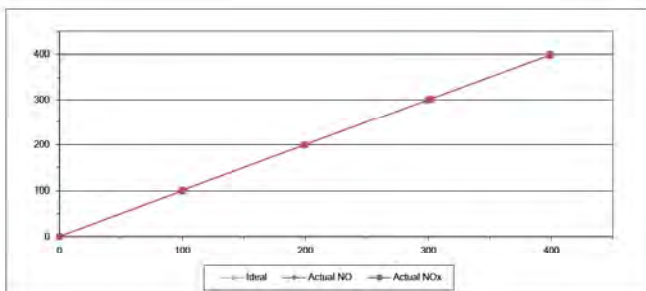
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. 8G314J3K Equipment ID RYG_FS0264
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.05	0.05	0.05	0.10	0.10	0.10
1	100.00	99.20	-0.80	-0.80	100.10	0.10	0.10
2	200.00	198.70	-1.30	-0.65	199.30	-0.70	-0.35
3	300.00	298.60	-1.40	-0.47	301.40	1.40	0.47
4	400.00	398.60	-1.40	-0.35	398.80	-1.20	-0.30
AVERAGE (%)				-0.44			0.00



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

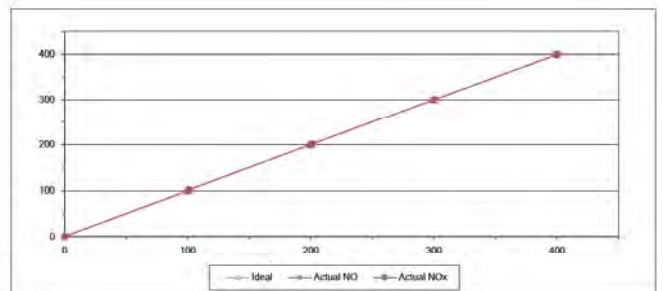
ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date 2-Jul-25 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. H73KYD1M Equipment ID BKK_FS0797
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 947
 Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222
 Cylinder Pressure (psi) 1800 Certified By Airgas Inc.
 Certified Date 9-Feb-22 Expired Date 9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.60	-1.40	-0.70	201.10	1.10	0.55
3	300.00	299.10	-0.90	-0.30	299.70	-0.30	-0.10
4	400.00	401.10	1.10	0.28	399.50	-0.50	-0.13
AVERAGE (%)				-0.18			0.28



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
: Cup anemometer
MANUFACTURER
: Novatex
MODEL/TYPE
: Sensor: WS-02F
Data logger: 200-WS-250L
SERIAL NUMBER
: Sensor: WSD-A4985
Data logger: A4985
ID NUMBER
: RVG_P50085
CONDITION AS-RECEIVED
CUSTOMER
: Used item
ALS laboratory group (Thailand) Co., Ltd.
104 Phantanasarak 40, Phantanasarak Rd. Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE
: 10 Jan 2025
MEASUREMENT DATE
: 15 Jan 2025
ISSUE DATE
: 16 Jan 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010.0 ± 1.0 hPa

PLACE OF CALIBRATION

: Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

: Wind tunnel cross-section area: 900 cm²
Wind direction frontal area: 100 cm²
Diameter of mounting pipe: mm
Blockage ratio of test object: 0.111 [-]

Preconditioning

Measurement Condition

: 24 hours at ambient conditions.

The average values during measurement are (24.4) °C, (59.8) %RH and (1011.1) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
☒ Mr. Sorawit Thirakulchai
☐ Miss Jiraporn Jirapornchai

Remark:
1. Nozzle cross-section area of the wind tunnel
2. Projected cross-section area of the tested object include mounting pipe
3. Diameter of mounting pipe
4. Ratio "to"

Approved signature:
Mr. Panyaporn Boonchaisri
Calibration Department Manager
REVIEW BY:
APPROVED BY:
NEXT CAL DATE: 15/ 07/ 26

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the power plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

U_{ref} (m/s)	Temp. wind tunnel (°C)	Temp. room (°C)	U_{meas} (m/s)	Error (m/s)	U (k=2) (m/s)
0.586	24.50	24.40	0.9	0.1	0.31
2.220	24.50	24.40	2.0	0.2	0.71
3.010	24.40	24.40	3.0	0.0	0.45
4.224	24.42	24.40	4.0	0.2	0.31
4.98	24.52	24.40	5.0	0.0	0.46
5.92	24.30	24.40	6.0	0.0	0.31
7.04	24.34	24.40	7.0	0.0	0.31
8.04	24.44	24.40	8.0	0.0	0.31
8.99	24.34	24.40	9.1	0.1	0.45
10.05	24.54	24.40	10.0	0.0	0.34
11.15	24.62	24.40	11.1	0.0	0.48
12.01	24.32	24.40	12.0	0.0	0.39
13.08	24.68	24.40	13.1	0.0	0.52
13.99	24.36	24.40	14.0	0.3	0.40
15.06	24.40	24.40	15.3	0.3	0.37
16.01	24.50	24.40	16.2	0.2	0.54

Remark:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

² Velocity of standard

³ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer (shown) may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.



CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
: Wind Direction Sensor
MANUFACTURER
: Novatex
MODEL/TYPE
: Sensor: WS-02F
Data logger: 200-WS-250L
SERIAL NUMBER
: Sensor: WSD-A4985
Data logger: A4985
ID NUMBER
: RVG_P50085
CONDITION AS-RECEIVED
CUSTOMER
: Used item
ALS laboratory group (Thailand) Co., Ltd.
104 Phantanasarak 40, Phantanasarak Rd. Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE
: 15 Jan 2025
MEASUREMENT DATE
: 15 Jan 2025
ISSUE DATE
: 16 Jan 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010.0 ± 1.0 hPa

PLACE OF CALIBRATION

: Effel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITION

: Wind tunnel cross-section area: 900 cm²
Wind direction frontal area: 129 cm²
Diameter of mounting pipe: mm
Blockage ratio of test object: 0.143 [-]

Preconditioning

Measurement Condition

: 24 hours at ambient conditions.

The average values during measurement are (23.7) °C, (54.3) %RH and (1012.4) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:
☒ Mr. Sorawit Thirakulchai
☐ Miss Jiraporn Jirapornchai

Remark:
1. Nozzle cross-section area of the wind tunnel
2. Projected cross-section area of the tested object include mounting pipe
3. Diameter of mounting pipe
4. Ratio "to"

Approved signature:
Mr. Panyaporn Boonchaisri
Calibration Department Manager
REVIEW BY:
APPROVED BY:
NEXT CAL DATE: 15/ 07/ 26

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Page 2 of 2 Pages

MEASUREMENT RESULTS¹

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

Air speed m/s	θ'_{me} Degree (°)	θ'_{ref} Degree (°)	Error Degree (°)	U (k=2) Degree (°)
5.01	45.000	41	-4	0.80
	90.000	87	-3	0.80
	135.000	132	-3	0.80
	180.000	181	1	0.80
	225.000	229	4	0.80
	270.000	274	4	0.80
	315.000	318	3	0.80
	360.000	359	-1	0.80

Remark:

¹ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

² Direction of standard

³ Direction of Unit Under Calibration

End of Certificate of Calibration



Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Certificate No : 25-ACT-042
Request No : Req-2025-0604

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : RION
Model : NC-75
Serial Number : 25002736
ID : RYG_FS0496
Class : 1
Range : 94 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 6 March 2025
Calibration Date : 19 March 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 19/03/26

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	12 June 2025
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : *[Signature]*
Mr. Noppadon Luangrat
Service Calibration Engineer

Approved By : *[Signature]*
Mr. Pacit Mathavom
Calibration Engineer Supervisor
Issue Date : 19 March 2025

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-706-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 25-ACT-042

Request No : Req-2025-0604

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.06	0.06	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Deviated	Measured (%)	Deviated			
94 dB / 1000 Hz	0.98	-	-	-	0.40	2.5	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibration pressure correction

- The calibration results exclude the microphone volume correction

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-706-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 25-ACT-042

Request No : Req-2025-0604

Decision Rule for Statements of Conformity

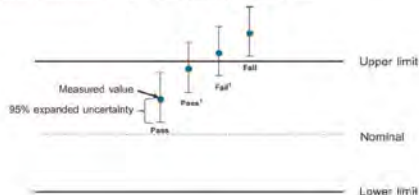
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2015: Guidelines on the Reporting of Compliance with Specifications as following Fig. and statements

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sithiporn Road, Bangburu, Bangkok, 10700 Thailand
Tel: +66 2432 8321 Email: calibration@sithiporn.com

Cert. No. : ACT25106

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00709746 / 187332 / 01297
ID No. : RYG_FS0491

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %
Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 26/ 01/ 2026

Calibrated by : Nathakorn Pisutpaisan

Approved by : *[Signature]*
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-706-ACT-02 Rev.03 Issue date 5/6/24

Cert. No. : ACL25106
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anchoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	IF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at:

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Z. Petch.

Cert. No. : ACL25106
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

Z. Petch.

Cert. No. : ACL25106
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	13.4
C - weight	20.0
Flat	25.5

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	±1.5
1000	0.2	0.2	0.2	±1.0
8000	2.1	2.1	2.1	±5.0

Z. Petch.

Cert. No. : ACL25106
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	-0.1	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.2
C - weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.3

Z. Petch.

Cert. No. : ACL25106
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.4	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

T. Petch.

Cert. No. : ACL25106
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	± 1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	± 1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

T. Petch.

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Pages : 8 of 8

10. Peak C round level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	± 3.0
One	133.4	133.4	0.0	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 2.0
Positive half cycle	135.4	135.1	-0.3	± 2.0
Negative half cycle	135.4	135.1	-0.3	± 2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	± 1.5
89.5	89.5		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	± 0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

451-451/1 Sirinthorn Road, Bangpoo, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL25107
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00900071 / 188464 / 01733
ID No. : RYG_FS0492

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

Calibrated by :

Nadukorn Pitsutpaisan

Approved by :

T. Petch.
(Thanakul Petchurai)

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Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302/42	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 3 of 8**Summary of Measurement Result :**

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Page : 4 of 8**Result of calibration :**

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	18.4
Flat	24.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.1	0.1	0.1	±1.0
8000	0.9	0.9	0.9	±5.0

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±3.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.2
C - weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.3

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.2	0.2	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

T. Petch.

Cert. No. : ACL25107
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k=2$, or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

451-451/1 Sirithorn Road, Bangkumru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL25108
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00900072 / 188465 / 01734
ID No. : RYG_FS0493

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

REVIEW BY : 
APPROVED BY : 
NEXT CAL DATE : 26/ 01/ 2026

Calibrated by :

Nathakorn Pisuipaisan

Approved by :

T. Petch.
(Thanakul Petchurai)

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Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM test tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For test results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302/42	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

- This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
- This certificate is traceable to the international system of unit maintained at :
 - National Institute of Metrology (Thailand).
 - Thailand Institute of Scientific and Technological Research (TISTR).

S. Petcha.

Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

S. Petcha.

Cert. No. : ACL25108
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.0
Flat	22.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-0.4	-0.4	-0.4	± 5.0

S. Petcha.

Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative (a) 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±3.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

S. Petcha.

Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

T. Petch

Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	± 1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.8	0.2	± 1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	± 1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	± 1.0

T. Petch

Cert. No. : ACL25108
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	± 3.0
One	133.4	133.1	-0.3	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	± 2.0
Positive half cycle	135.4	135.2	-0.2	± 2.0
Negative half cycle	135.4	135.2	-0.2	± 2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	± 1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	± 0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor k = 2 or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

451-451/ Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL25109
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 0090073 / 188466 / 01735
ID No. : RYG_FS0494

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petch
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302/42	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long-term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A-weight	12.0
C-weight	18.3
Flat	24.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.0	1.0	1.0	±5.0

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.1	0.0	±2.0
125	0.0	0.1	0.1	±1.5
250	0.0	0.1	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.1	±1.0
2000	-0.1	0.1	0.0	±2.0
4000	-0.1	0.1	0.0	±3.0
8000	-0.1	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.1	0.1	±0.3

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

T. Petch.

Cert. No. : ACL25109
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.

451-451/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email: calibration@sithiporn.comCert. No. : ACL25110
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 0090074 / 188467 / 01736
ID No. : RYG_FS0495

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUWAENG PHATTHANAKAN, KHUET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petch.
(Thanakul Petchurai)

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Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For test results of each items were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 3 of 8**Summary of Measurement Result :**

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Page : 4 of 8**Result of calibration :**

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	+0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	17.7
Flat	23.2

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.3	0.3	0.3	± 5.0

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.1	0.1	±1.1
134.0	134.1	0.1	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.1	0.1	±1.1
114.0	114.1	0.1	±1.1
109.0	109.0	0.0	±1.1
104.0	104.1	0.1	±1.1
99.0	99.1	0.1	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.1	0.1	±1.1
28.0	28.1	0.1	±1.1
27.0	27.1	0.1	±1.1
26.0	26.2	0.2	±1.1
25.0	25.2	0.2	±1.1

Z. Peth.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.1	0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Z. Peth.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Z. Peth.

INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
71/10 MOO 13, 90/1 SENTENAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PLEI SAMUT PRAKAN PROVINCE 10141 THAILAND
TEL. (660-2110-5800-1 FAX: (660-2110-7140)

IAC-MRA



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Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : RION
Model : NC-74
Serial Number : 34178121
ID : RYG_FS0213Class : 1
Range : 94 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 15 January 2025
Calibration Date : 16 January 2025

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NIMT	16 January 2025

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 16 January 2025

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	94.11	0.11	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Deviated	Measured (%)	Deviated			
94 dB / 1000 Hz	1.21	-	-	-	0.40	2.5	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

-Acceptance limit was IEC60942:2017 Class 1

-The calibration results exclude the calibrator pressure correction

-The calibration results exclude the microphone volume correction

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Decision Rule for Statements of Conformity

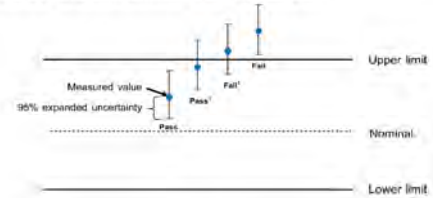
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail² = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-ACT-02 Rev.03 Issue date 5/6/24

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangpoomu, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24299

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01173614 / 172176 / 74026
ID No. : NRKH_FS0027

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 11 SEPTEMBER 2024
Calibration Date : 01-02 OCTOBER 2024
Date of Issue : 02 OCTOBER 2024



Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangpoomu, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24299

Job No. : VC67AC0158

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each item were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52202742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petchurai

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

Z. Petch.

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	18.1
Flat	23.8

3. Acoustical signal tests of frequency weightings

Meter free field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.6	-0.5	-0.5	±5.0

Z. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
1eq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

Z. Petch.

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.1	0.1	± 1.1
30.0	30.3	0.3	± 1.1
29.0	29.4	0.4	± 1.1
28.0	28.6	0.6	± 1.1
27.0	27.6	0.6	± 1.1
26.0	26.9	0.9	± 1.1
25.0	26.0	1.0	± 1.1

Z. Petch.

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Cert. No. : ACL24299
Job No. : VC67AC0158
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	30.0	30.3	0.3	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24299
Job No. : VC67AC0158
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Sirinthorn Road, Bangbunmu, Bangkok, 10700 Thailand
Tel : +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL25257
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709775 / 187361 / 01326
ID No.: NIKH_FS0069

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 26 JUNE 2025
Calibration Date : 01 JULY 2025
Date of Issue : 02 JULY 2025



Calibrated by : Nathakorn Pisutpaisan

Approved by : *Wichok Ekpongpradit*
(Wichok Ekpongpradit)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.



SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : ACL25257
Job No. : VC68AC0134
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL-BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL-BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34360493	AA-3002-25	19-FEB-26

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).
- 3.3 Electrical And Electronics Institute (EEI).

Wichok E.

Cert. No. : ACL25257
Job No. : VC68AC0134
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

SITHIPORN ASSOCIATES

Cert. No. : ACL25257
Job No. : VC68AC0134
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	10.8
C - weight	17.2
Flat	22.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

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Cert. No. : ACL25257
Job No. : VC68AC0134
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.0	±3.0
8000	0.1	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

SITHIPORN ASSOCIATES

Cert. No. : ACL25257
Job No. : VC68AC0134
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

SITHIPORN ASSOCIATES

Cert. No. : ACL25257
Job No. : VC68AC0134
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.0 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Continued

Cert. No. : ACL25257
Job No. : VC68AC0134
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10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	Value (dB)	Limits (dB)
89.6	89.5		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.1	+0.1	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Cert. No. : ACL24420
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623389 / 198636 / 26417
ID No.: RYG_FS0614

Condition As Found : GOOD

Customer : A.I.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

Calibrated by :

Nathakorn Pisutpaian

Approved by :

(Thanakul Petchurai)

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments. For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	HA-42KAL	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

(Thanakul Petchurai)

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C - sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch

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Cert. No. : ACL24420
Job No. : VC68AC0051
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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	9.9
C - weight	16.8
Flat	22.7

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	±1.5
1000	0.2	0.2	0.2	±1.0
8000	0.4	0.5	0.5	±5.0

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.2
C - weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.3

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Cert. No. : ACL24420
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	25.0	0.0	±1.1

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.8	-0.2	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Cert. No. : ACL24420
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Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	131.1	-1.9	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.3

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Cert. No. : ACL24421
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623390 / 198637 / 26418
ID No.: RYG_P80615

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchu
(Thanakul Petchurai)

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Cert. No. : ACL24421
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL24421
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch

Cert. No. : ACL24421
Job No. : VC68AC0051
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Result of calibration :

1. Absolute sensitivity

Reference: Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	19.5
Flat	24.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	0.0	0.0	0.0	± 5.0

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Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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Cert. No. : ACL24421
Job No. : VC68AC0051
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 0.2
136.0	136.0	0.0	± 0.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24421
Job No. : VC68AC0051
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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Cert. No. : ACL24421
Job No. : VC68AC0051
Pages : 8 of 8

10. Peak C annual level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email: calibration@sithiporn.com

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Cert. No. : ACL24422
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00623391 / 198638 / 26419
ID No.: RYG_FS0616

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

Calibrated by : Nathakorn Pisuatpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY53202742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TIST).

Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

7. Patch

Cert. No. : ACL24422
Job No. : VC68AC0051
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	14.8
C - weight	21.3
Flat	26.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-0.7	-0.6	-0.6	± 5.0

7. Patch

Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±2.0
125	0.0	0.0	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz:

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

7. Patch

Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

7. Patch

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CALIBRATION LABORATORY

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Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	29.4	0.4	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

T. Petch

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Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

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Cert. No. : ACL25078
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00623393 / 198640 / 26421
ID No.: RYG_FS0618

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

REVIEW BY *Spt S*
APPROVED BY *T. Petch*
NEXT CAL DATE: 20/ 01/ 2026

Calibrated by : Nithakorn Pisutpasan

Approved by : *T. Petch*
(Thanakul Petchurai)

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CALIBRATION LABORATORY

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anchoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-HP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-HP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-HP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

Z. Petch

Cert. No. : ACL25078
Job No. : VC68AC0059
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	13.1
C - weight	17.9
Flat	24.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	± 3	2.2	2.3	± 5.0

Z. Petch

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	± 2.0
125	0.0	0.0	0.0	± 1.5
250	0.0	0.0	-0.1	± 1.5
500	0.0	0.0	-0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
2000	0.0	0.0	0.0	± 2.0
4000	0.0	0.0	0.0	± 3.0
8000	0.0	0.1	0.1	± 5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Log	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

Z. Petch

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

Z. Petch

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

T. Petchurai

Cert. No. : ACL25078
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	-0.1	±1.3

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petchurai

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24385
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00222599 / 195911 / 15431
ID No. : NKH_FS0118

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 15 NOVEMBER 2024
Calibration Date : 03-04 DECEMBER 2024
Date of Issue : 04 DECEMBER 2024

REVIEW BY	<i>T. Petchurai</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL DATE	03/12/25

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. : +66 2433 8331 Email : calibration@sithiporn.comCert. No. : ACL24385
Job No. : VC68AC0033
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each instruments display and also with SUM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	13-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-43KA	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Cert. No. : ACL24385
Job No. : VC68AC0033
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Cert. No. : ACL24385
Job No. : VC68AC0033
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	9.9
C - weight	16.4
Flat	22.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.4	±1.5
1000	0.1	0.1	0.2	±1.0
8000	0.3	0.4	0.4	±5.0

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Cert. No. : ACL24385
Job No. : VC68AC0033
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.2
C - weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	±0.3

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Cert. No. : ACL24385
Job No. : VC68AC0033
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	78.9	-0.1	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	63.9	-0.1	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	44.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
34.0	33.9	-0.1	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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Job No. : VC68AC0033
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

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Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petchu

T. Petchu

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Cert. No. : ACL24386
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00222600 / 195912 / 15432
ID No. : NK11 FS0119

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 15 NOVEMBER 2024
Calibration Date : 03-04 DECEMBER 2024
Date of Issue : 04 DECEMBER 2024

REVIEW BY : *[Signature]*
APPROVED BY : *[Signature]*
NEXT CAL DATE : 03/12/25

Calibrated by : Natthakorn Pisutpaisan

Approved by : *T. Petchu*
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL24386
Job No. : VC68AC0033
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05 FEB 25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24386
Job No. : VC68AC0033
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Cert. No. : ACL24386
Job No. : VC68AC0033
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.9)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.2

2.2 The microphone of the sound level meter was replaced by electrical signal input device:

Frequency Weighting	Weighting (dB)
A-weight	8.7
C-weight	15.7
Flat	31.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	±1.5
1000	0.1	0.1	0.2	±1.0
8000	-0.6	-0.6	-0.5	±3.0

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Job No. : VC68AC0033
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.2
C-weight	94.0	94.0	0.0	±0.2
Flat	94.0	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	±0.1
Slow	94.0	94.0	0.0	±0.1
Leq	94.0	94.0	0.0	±0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

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Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

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Cert. No. : ACL24386
Job No. : VC68AC0033
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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Cert. No. : ACL24386
Job No. : VC68AC0033
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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Cert. No. : ACL25080
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 00920831 / 22191 / 22220
ID No.: RYG_F30622

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurui)

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SITHIPORN ASSOCIATES

SITHIPORN ASSOCIATES
CALIBRATION LABORATORY

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EP-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EP-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch

Cert. No. : ACL25080
Job No. : VC68AC0059
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	8.7
C - weight	13.7
Flat	19.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	0.6	0.6	0.6	-1.5 - 2.5

T. Petch

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±1.0
125	0.1	0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

T. Petch

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	25.0	0.0	±0.8

T. Petch

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.8

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

Cert. No. : ACL25080
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±2.0
One	133.4	133.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.1

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

451-451/1 Sirinthorn Road, Bangsue, Bangkok, 10700 Thailand
Tel. +66 2423 8338 Email : calibration@sithiporn.comCert. No. : ACL25086
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 01122578 / 143842 / 74027
ID No. : RYG_FS0017

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 27 JANUARY 2025
Date of Issue : 28 JANUARY 2025

Calibrated by : Nathakorn Pirupaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL-BP 21/0267	15-FEB-25
Digital Multimeter	33461A	MY53220076	EEL-BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL-BP 22/0267	15-FEB-25
Programmable Attenuator	MAT 1070	62100114	EF 0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA 3001-24	05-FEB-25

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

T. Petch

Cert. No. : ACL25086
Job No. : VC68AC0059
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
17.6

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	11.6
C - weight	17.5
Flat	23.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	0.2	0.2	0.2	±5.0

T. Petch

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

T. Petch

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	48.9	-0.1	± 1.1
44.0	43.9	-0.1	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

T. Petch

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

Cert. No. : ACL25086
Job No. : VC68AC0059
Pages : 8 of 8

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$ or any value following calculation, providing a level of confidence of approximately 95 %.

End of Calibration Certificate

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research

DATE OF ISSUE 13 February 2025 CERTIFICATE NUMBER 232797

Cirrus Research
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory
R Thomas
Electronically signed:

doseBadge Reader : IEC 60942:2003

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: RC-110A

Serial number: 73729

Class: 2

Test summary

Date of calibration: 12 February 2025

The doseBadge reader detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK-224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

The doseBadge Reader has been shown to conform to the Class 2 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of doseBadge Reader conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the doseBadge Reader to the requirements of IEC 60942:2003.

Notes:

REVIEW BY

APPROVED BY

NEXT CAL DATE: 11/02/2026

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
232797

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 101.42 kPa Temperature: 25.1 °C Humidity: 33.1 %
After Pressure: 101.42 kPa Temperature: 25.2 °C Humidity: 35.9 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	1063074
Environmental Monitor	Comet	T7510	21962628

Initial Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	112.51	112.45	112.61	112.52	-1.48	±0.75	0.11 dB
Distortion (%)	< 4.00	1.46	1.70	2.01	1.72	1.72	+4.00	0.13 %
Frequency (Hz)	1000.0	998.2	998.2	998.2	998.2	-1.8	±20.0	0.1 Hz

The measured quantities or deviations (as applicable), extended by the expanded combined uncertainty of measurement, must not exceed the corresponding tolerance.

Adjusted Acoustic Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Tolerance	Uncertainty
Level (dB)	114.00	114.00	113.99	114.01	114.00	0.00	±0.75	0.11 dB
Distortion (%)	< 4.00	0.97	0.96	0.95	0.96	0.96	+4.00	0.13 %
Frequency (Hz)	1000.0	998.1	998.1	998.1	998.1	-1.9	±20.0	0.1 Hz

Functionality Results

Function	Result
Keypad	Pass
Battery Power	Pass
Display	Pass
Communication	Pass
2 way IR link	Pass
Clock	Pass

End of results

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Plathankarn 40, Plathankarn Road, Suan Luang,
Bangkok 10250

Certificate No : 25-ACT-077
Request No : Req-2025-1050

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : Cirrus
Model : CR-516
Serial Number : 100249
ID : RYG_FS0635
Class : 2
Range : 94, 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 14 May 2025
Calibration Date : 26 May 2025
Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NMI	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : Mr. Noppadon Luangrat
Service Calibration Engineer
Approved By : Mr. Pacit Mathavon
Calibration Engineer Supervisor
Issue Date : 26 May 2025

The results related only to the items calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-ACT-02 Rev.04 Issue date 17/1/25

Certificate No : 25-ACT-077
Request No : Req-2025-1050

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.86	-0.14	-	-	0.11
114 dB / 1000 Hz	113.83	-0.17	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.0	0.00	-	-	0.01
114 dB / 1000 Hz	1000.0	0.00	-	-	0.010

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (%)	Measured (%)	Measured (%)	Measured (%)	
94 dB / 1000 Hz	2.31	-	-	-	0.17
114 dB / 1000 Hz	0.91	-	-	-	0.17

Note :

- The calibration results exclude the barometric pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the items calibrated. This certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-ACT-02 Rev.04 Issue date 17/1/25

CERTIFICATE OF CALIBRATION

ISSUED BY : Cirrus Research plc

DATE OF ISSUE : 29 April 2025

CERTIFICATE NUMBER : 239328

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 8

Approved signatory
N.Smith
Electronically signed:

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer : Cirrus Research plc
Model : CR-120A
Serial number : MK502824
Firmware version : 1.1.1840

Notes:

Test summary

Date of calibration : 28 April 2025

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDD7R6629
Attenuator	Cirrus Research	ZE 952	96919
Environmental Monitor	Comet	T7510	16966334

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

REVIEW BY : Mr. Noppadon Luangrat
APPROVED BY : Mr. Pacit Mathavon
NEXT CAL DATE : 19/4/26

Calibration report number
CDM-113-47

CALIBRATION REPORT

Page 1 of 3 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Dose meter
: Cirrus Research plc
: CR-120A
: V7421
: RYG_FS0042
: Used item
: ALS Laboratory Group (Thailand) Co., Ltd.
104 Plathankarn 40, Plathankarn Road, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:
The Route dosimeter (Unit Under Calibration) was calibrated against standard dosimetry, model, RC-120A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2002 when applicable.

Traceability:
This certificate provides a traceability of the measurement to the realization of the international system of units (SI) through Cirrus Research plc via Certificate number: 238630

RECEIVED DATE : 16 Sep 2024
MEASUREMENT DATE : 17 Sep 2024
ISSUE DATE : 18 Sep 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 35.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

PRECONDITIONING

: The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:

Instrument name : DoseBadge Reader Manufacturer : Cirrus Research plc Model : RC110A Serial number : 81051
Remarks : doseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2008 Class 2

CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
[] Mr. Sorawat Thachulad
[] Miss Jitraporn Jitrasomphol

Approved signatory:
Mr. Paitoon Boonchaisan
Calibration Department Manager

Remarks:
¹ The decimal level of standard doseBadge reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 2 of 8

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 101.98 kPa Temperature: 20.8 °C Humidity: 52.5 %
After Pressure: 101.98 kPa Temperature: 20.9 °C Humidity: 52.1 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Response to unipolar pulses	Complies
Overload Latching	Complies
Frequency weighting	Complies

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 3 of 8

Laboratory uncertainties

Requirement	Value
Absolute acoustic sensitivity	0.2 dB
Level linearity	0.15 dB
Short duration signals	0.2 dB
Unipolar Pulses	0.2 dB
Overload latching indication	0.2 dB
Electrical freq. weighting 63 Hz	0.15 dB
Electrical freq. weighting 125 Hz	0.15 dB
Electrical freq. weighting 250 Hz	0.15 dB
Electrical freq. weighting 500 Hz	0.15 dB
Electrical freq. weighting 2 kHz	0.15 dB
Electrical freq. weighting 4 kHz	0.15 dB
Electrical freq. weighting 8 kHz	0.15 dB

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 4 of 8

B1: Absolute Acoustical Sensitivity

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Name	Input Level (dB)	Reading (dB)	Deviation (dB)	Limits (dB)
Initial	94	93.92	0.08	93 / 95
Adjusted	94	94.00	0	93 / 95

B2: Linearity Of Responce To Steady Signals

Result: **Passed**

Frequency: 63 Hz Uncertainty: 0.2 dB Range: 93.8 – 113 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
93.8	0.005331	0.005447	20	-0.000116	0.004211 / 0.006717	2	-21 / +26
98.8	0.016857	0.016783	20	0.000074	0.013317 / 0.021240	-0	-21 / +26
103.8	0.053307	0.054780	20	-0.001473	0.042113 / 0.067167	3	-21 / +26
108.8	0.168573	0.166353	20	0.002220	0.133173 / 0.212402	-1	-21 / +26
113	0.443392	0.453690	20	-0.010298	0.350289 / 0.558674	2	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 5 of 8

Frequency: 1000 Hz Uncertainty: 0.2 dB Range: 65 – 140 dB

Input Level (dB)	Expected Exposure (Pa²h)	Exposure (Pa²h)	Duration (s)	Deviation (Pa²h)	Limits (Pa²h)	Deviation (%)	Limits (%)
65	0.000007	0.000007	20	-0.000000	0.000006 / 0.000009	0	-21 / +26
70	0.000022	0.000021	20	0.000001	0.000017 / 0.000028	-5	-21 / +26
75	0.000070	0.000069	20	0.000001	0.000055 / 0.000088	-1	-21 / +26
80	0.000222	0.000222	20	-0.000000	0.000175 / 0.000280	0	-21 / +26
85	0.000703	0.000677	20	0.000026	0.000555 / 0.000886	-4	-21 / +26
90	0.002222	0.002217	20	0.000005	0.001755 / 0.002800	-0	-21 / +26
95	0.007027	0.006879	20	0.000148	0.005551 / 0.008854	-2	-21 / +26
100	0.022222	0.021478	20	0.000744	0.017555 / 0.028000	-3	-21 / +26
105	0.070273	0.072282	20	-0.002009	0.055516 / 0.088544	3	-21 / +26
110	0.222222	0.221030	20	0.001192	0.175555 / 0.280000	-1	-21 / +26
115	0.702728	0.730243	20	-0.027515	0.555155 / 0.885437	4	-21 / +26
120	2.222222	2.212458	20	0.009764	1.755555 / 2.800000	-0	-21 / +26
125	7.027284	7.192280	20	-0.164996	5.551554 / 8.854378	2	-21 / +26
130	22.222223	23.260048	20	-1.037825	17.555556 / 28.000001	5	-21 / +26
135	70.272839	70.472214	20	-0.199375	55.515543 / 88.543777	0	-21 / +26
140	222.222228	225.813004	20	-3.590776	175.555560 / 280.000007	2	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 6 of 8

Frequency: 8000 Hz Uncertainty: 0.2 dB Range: 88.9 – 108.9 dB

Input Level (dB)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Duration (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
88.9	0.001725	0.001680	20	0.000045	0.001363 / 0.002174	-3	-21 / +26
93.9	0.005455	0.005360	20	0.000095	0.004309 / 0.006673	-2	-21 / +26
98.9	0.017250	0.016890	20	0.000360	0.013626 / 0.021735	-2	-21 / +26
103.9	0.054549	0.053499	20	0.001050	0.043084 / 0.066732	-2	-21 / +26
108.9	0.172499	0.166353	20	0.006146	0.136274 / 0.217349	-4	-21 / +26

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 7 of 8

B3: Frequency Weightings

Result: **Passed**

Reference Frequency: 1000 Hz Reference Exposure: 111.67121887207
Reference Input Level: 137 dB Duration: 20 Seconds

Frequency (Hz)	Exposure (Pa ² h)	Exposure Ratio	Ratio Limit	Uncertainty
63	0.266311	0.0024	0.0015 / 0.0038	0.15
125	2.746982	0.0246	0.0174 / 0.0347	0.15
250	15.976163	0.1431	0.098 / 0.195	0.15
500	53.437450	0.4785	0.339 / 0.676	0.15
2000	146.177551	1.3269	0.832 / 2.089	0.15
4000	119.963051	1.0743	0.631 / 2.512	0.15
8000	65.789391	0.5891	0.246 / 2.455	0.15

B4: Short-Duration Signals

Result: **Passed**

Uncertainty: 0.2 dB Frequency: 4000 Hz

Input Level (dB)	Burst Level (dB)	Ratio	Duration (s)	Burst Duration (ms)	Duration Between Bursts (ms)	Expected Exposure (Pa ² h)	Exposure (Pa ² h)	Deviation (%)	Limits (%)
114	95	1:100	10	10	990	0.002791	0.003057	10	-21 / +26
124	95	1:1000	10	1	999	0.002791	0.003224	16	-21 / +26
129	100	1:1000	10	1	999	0.008826	0.009796	11	-29 / +41
129	100	1:1000	10	10	990	0.008826	0.009246	5	-29 / +41
139	110	1:1000	10	1	999	0.088259	0.102917	17	-29 / +41

CERTIFICATE OF CALIBRATION

Certificate Number:
239328
Page 8 of 8

B5: Response to Unipolar Pulses

Result: **Passed**

Uncertainty: 0.2 dB Frequency: 1000 Hz

Positive Exposure (Pa ² h)	Negative Exposure (Pa ² h)	Integration Time (s)	Deviation (Pa ² h)	Limits (Pa ² h)	Deviation (%)	Limits (%)
11.292405	11.503055	30	-0.210649	8.921 / 14.22843	2	-21 / +26

B6: Latching Overload Indicator

Result: **Passed**

Frequency: 1000 Hz Uncertainty: 0.2 dB

Level (dB)	Expected To Overload	Overloaded
140	No	No
143	Yes	Yes



JIRANATTE ASSOCIATES CO., LTD.
67/34-35, 67/35-36,
Petchkasem 7/71 Rd. Watthana, Bangkok,
Bangkok 10320 (Thailand)
Tel: +66(0)262817
Mobile: +66(0)9399453
E-mail: jnc.calibration@jnc-prates.com
Web site: www.jiranat.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TSA-TIS 17025
CALIBRATION SIG?

Acoustic calibration laboratory
Calibration services department

REVIEW BY: *Worawan P.*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 12/19/26

Calibration Report Number
CDM-104-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
TO NUMBER
CONDITION AS-RECEIVED
CUSTOMER

Dose meter
Cetus Research plc
CR110A5
YH472
NYG-F50033
Used item
A15 Laboratory Group (Thailand) Co., Ltd.
10A Phatthanasarak 40, Phatthanasarak Rd., Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:
The noise dosimeter (Unit Under Calibration) was calibrated against Sennheiser dosacal 30000 meter model NC-110A which the calibration was performed respecting the requirements of ISO/IEC 17025:2017 and carried out in accordance with the requirements of IEC 60942:2003 where applicable.

RECEIVED DATE: 16 Sep 2024
MEASUREMENT DATE: 17 Sep 2024
ISSUE DATE: 18 Sep 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

PRECONDITIONING

The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration being performed.

STANDARD USED DURING CALIBRATION:

Instrument name: dosacal 30000 Reader Manufacturer: Cetus Research plc Model: CR110A Serial number: 81051

Remark: dosacal 30000 Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

Dosacal 30000 Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
[X] Mr. Sorawit Thachalad
[X] Miss Jirassorn Kiensothorn



Approved signature: *[Signature]*
Mr. Panyai Booncharoen
Calibration Department Manager

Remark:
¹ The decibel level of standard dosacal reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

End of results

Page 1 of 1 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

PRECONDITIONING

STANDARD USED DURING CALIBRATION:
Instrument name: DoseBadge Reader Manufacturer: Cirrus Research plc Model: RC-110A Serial number: B1051
Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Remarks:
¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.

Page 1 of 1 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

PRECONDITIONING

STANDARD USED DURING CALIBRATION:
Instrument name: DoseBadge Reader Manufacturer: Cirrus Research plc Model: RC-110A Serial number: B1051
Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Remarks:
¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.

Page 1 of 1 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

PRECONDITIONING

STANDARD USED DURING CALIBRATION:
Instrument name: DoseBadge Reader Manufacturer: Cirrus Research plc Model: RC-110A Serial number: B1051
Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Remarks:
¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.

Page 1 of 1 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follows:
Temperature
Relative Humidity
Atmospheric Pressure

PRECONDITIONING

STANDARD USED DURING CALIBRATION:
Instrument name: DoseBadge Reader Manufacturer: Cirrus Research plc Model: RC-110A Serial number: B1051
Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2

CALIBRATION RESULTS:
Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level ¹ (dB)	Noise Dosimeter reading ² (dB)	Error (dB)	Status
114.0	114.0	0.0	✓

Calibrated by:
☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Remarks:
¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.
² The measurement reading of Unit Under Calibration.



J NAC
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Web site: www.jiranate.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TS-175 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department

REVIEW BY *Manthan P.*
APPROVED BY *[Signature]*
NEXT CAL DATE *23/4/24*

Calibration report Number

CDM-125-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Dose meter

Cirrus Research plc

CR-120A

MKS02817

RYG_F50639

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was

calibrated against a standard dosimeter reader

model RC-110A which the calibration was

performed respecting the requirements of ISO/IEC

17025:2017 and carried out in accordance with

the requirements of IEC 60942:2003 where

applicable.

Traceability:

This certificate provides a traceability of the

measurement to recognized the national

standards, and to realization of the international

system of units (SI) through Cirrus research plc via

Certificate number: 214610

RECEIVED DATE

27 Sep 2024

MEASUREMENT DATE

27 Sep 2024

ISSUE DATE

01 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient conditions in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

PRECONDITIONING

The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration

being performed.

STANDARD USED DURING CALIBRATION:

Instrument name: DoseBadge Reader

Manufacturer: Cirrus Research plc

Model: CR-516

Serial number: 55838

Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level¹

(dB)

114.0

Noise Dosimeter reading²

(dB)

114.0

Error (dB)

0.0

Status

✓

114.0

114.0

0.0

✓

Calibrated by:

☒ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol

☒ Miss Suangsang Plomont



Approved signature

Mr. Parinya Booncharoen

Calibration Department Manager

Remarks:

¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

² The measurement reading of Unit Under Calibration.

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



J NAC
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Web site: www.jiranate.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TS-175 17025
CALIBRATION 0367

Acoustic calibration laboratory
Calibration services department

REVIEW BY *Manthan P.*
APPROVED BY *[Signature]*
NEXT CAL DATE *21/10/26*

Calibration report Number

CDM-177-67

CALIBRATION REPORT

Page 1 of 1 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS RECEIVED

CUSTOMER

Dose meter

Cirrus Research plc

CR-120A

MKS02818

RYG_F50639

Used item

ALS laboratory group (Thailand) Co., Ltd.

104 Phatthanakan Rd, Khwaeng Suan Luang,

Khet Suan Luang, Bangkok 10250 Thailand

Calibration procedure:

The Noise dosimeter (Unit Under Calibration) was

calibrated against a standard doseBadge reader

model RC-110A which the calibration was

performed respecting the requirements of ISO/IEC

17025:2017 and carried out in accordance with

the requirements of IEC 60942:2003 where

applicable.

Traceability:

This certificate provides a traceability of the

measurement to recognized the national

standards, and to realization of the international

system of units (SI) through Cirrus research plc via

Certificate number: 214610

RECEIVED DATE

01 Oct 2024

MEASUREMENT DATE

02 Oct 2024

ISSUE DATE

04 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient conditions in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C

Relative Humidity: 55.0 ± 15.0 %RH

Atmospheric Pressure: 1010 ± 10 hPa

PRECONDITIONING

The dose meter (Unit Under Calibration) was preconditioning 24 hours at ambient conditions prior to calibration

being performed.

STANDARD USED DURING CALIBRATION:

Instrument name: DoseBadge Reader

Manufacturer: Cirrus Research plc

Model: CR-516

Serial number: 55838

Remarks: DoseBadge Reader Unit with Internal Acoustic Calibrator to IEC 60942: 2003 Class 2.

CALIBRATION RESULTS:

Table 1: The results of dose meter calibration are reported in the table below.

DoseBadge Reader Level¹

(dB)

114.0

Noise Dosimeter reading²

(dB)

114.0

Error (dB)

0.0

Status

✓

114.0

114.0

0.0

✓

Calibrated by:

☒ Mr. Sorawit Thachalad

☒ Miss Jitraporn Lertsomphol

☒ Miss Suangsang Plomont



Approved signature

Mr. Parinya Booncharoen

Calibration Department Manager

Remarks:

¹ The decibel level of standard doseBadge reader that supplied to Unit Under Calibration.

² The measurement reading of Unit Under Calibration.

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Certificate of Calibration

Customer
Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Luang, Bangkok
10250

Certificate No : 25-AFM-238
Request No : Req-2025-1986

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Labs
Model : 200-510M
Serial Number : 151114
ID : BKK FS0614

Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 3 September 2025
Calibration Date : 10 September 2025
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	1850101006	Sensidyne	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	6 May 2026
Temperature meter	GT 11	08000057	Qehorn	15 October 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01 and MIT NSC-TISI-TIS Accreditation No. 0052

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %

Calibration By :
Mr. Noppadol Luangnang
Service Calibration Engineer

Approved By :
Mr. Pait Mahaveen
Calibration Engineer Supervisor
Issue Date : 10 September 2025

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.06 Issue date 21/2/25

Certificate No : 25-AFM-238
Request No : Req-2025-1986

Result of Calibration : Without Adjustment

STD Reading			UUC Reading			Error (cc/min)	Uncertainty	
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(°C)
25.5	100.98	100	-	-	100.02	0.0	3.6	1.0
25.7	100.97	503	-	-	500.81	-2.2	9.5	1.0
25.8	100.89	1003	-	-	1000.4	-3	19	1.0
26.1	100.88	2000	-	-	2001.9	2	38	1.0
26.5	100.85	3014	-	-	3002.2	-12	57	1.0
26.7	100.81	4027	-	-	4006.9	-26	76	1.0
27.0	100.74	5048	-	-	5001.8	-46	95	1.0

Note : STD = Standard UUC = Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition, Air.
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where : Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
meas = Measurement Condition ref = Standard Condition

* Indication not accredited

FM-91-LVFLOW-06

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.06 Issue date 21/2/25

ALS Laboratory Group (Thailand) Co., Ltd.
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Phatthanasak, Suan Luang, Bangkok 10250
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Certificate of Calibration

Certificate No : C-051025-RYG_FS0090

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilson
Model/Type : GSAir Plus
Equipment ID : RYG_FS0090
Serial No. : 20180610050
Calibration Date : 06-Oct-25
Next calibration date : 06-Jan-26

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : Mesa Labs
Model/Type : Defender 510-L
Equipment ID : RYG_FS0208
Serial No. : 130027
Calibration Date : 27-Jan-25
Due Date : 26-Jan-26

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : Mesa Labs
Model/Type : Defender 510-M
Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 10-Sep-25
Due Date : 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.7	19.5	20.1	19.8	5%	19 - 21	Passed
50	50.2	50.1	50.7	50.3	5%	48 - 53	Passed
100	101.1	99.6	100.6	100.6	5%	95 - 105	Passed
200	202.7	202.9	202.5	202.7	5%	190 - 210	Passed
High Flow							
500	501.8	504.9	501.3	502.7	3%	485 - 515	Passed
1000	1003.9	1002.9	1003.1	1003.2	3%	970 - 1030	Passed
2000	2009.3	1999.7	2002.3	2002.8	3%	1940 - 2060	Passed
2500	2505.7	2508.3	2508.8	2507.5	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By :
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)
Issue date : 07-Oct-25

Approved By :
(Mr. Supot Salameh)
Field Services Section Head

ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.
Phatthanasak, Suan Luang, Bangkok 10250
T +66 2 760 3000 F +66 2 760 3197



Certificate of Calibration

Certificate No : C-031025-RYG_FS0089

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
Brand : Gilson
Model/Type : GSAir Plus
Equipment ID : RYG_FS0089
Serial No. : 20221010029
Calibration Date : 03-Oct-25
Next calibration date : 03-Jan-26

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
Brand : Mesa Labs
Model/Type : Defender 510-L
Equipment ID : RYG_FS0208
Serial No. : 130027
Calibration Date : 27-Jan-25
Due Date : 26-Jan-26

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
Brand : Mesa Labs
Model/Type : Defender 510-M
Equipment ID : BKK_FS0614
Serial No. : 151114
Calibration Date : 10-Sep-25
Due Date : 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.9	19.4	19.6	19.6	5%	19 - 21	Passed
50	49.9	50.5	50.1	50.2	5%	48 - 53	Passed
100	99.7	99.9	99.5	99.7	5%	95 - 105	Passed
200	200.4	201.6	201.2	201.1	5%	190 - 210	Passed
High Flow							
500	505.3	501.9	502.3	503.2	3%	485 - 515	Passed
1000	1002.0	1003.4	1003.7	1003.0	3%	970 - 1030	Passed
2000	2000.6	2011.7	2005.8	2008.0	3%	1940 - 2060	Passed
2500	2505.1	2501.0	2508.7	2504.9	3%	2425 - 2575	Passed
4000	4002.4	4003.8	4000.7	4002.3	3%	3860 - 4120	Passed

END OF REPORT

Calibrated By :
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)
Issue date : 04-Oct-25

Approved By :
(Mr. Supot Salameh)
Field Services Section Head



Certificate of Calibration

Certificate No. C-021025-RYG_FS0672

Air Sampling Pump Detail

Equipment name: Personal Air Sampling Pump
Brand: Gilson
Model/Type: G4Air Plus
Equipment ID: RYG_FS0672
Serial No: 20230010000
Calibration Date: 02-Oct-25
Next calibration date: 02-Jan-26

Reference Standard Low Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 L
Equipment ID: RYG_FS0208
Serial No: 130027
Calibration Date: 27-Jan-25
Due Date: 26-Jan-26

Reference Standard High Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 M
Equipment ID: BKK_FS0614
Serial No: 151114
Calibration Date: 10-Sep-25
Due Date: 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.2	20.2	19.9	20.1	5%	19 - 21	Passed
50	51.5	51.7	51.6	51.6	5%	48 - 53	Passed
100	102.2	101.7	102.5	102.1	5%	95 - 105	Passed
200	199.5	200.8	200.1	200.1	5%	190 - 210	Passed
High Flow							
500	502.7	501.3	503.6	502.5	3%	485 - 515	Passed
1000	1001.3	1001.8	1002.7	1001.9	3%	970 - 1030	Passed
2000	2000.6	1999.7	2001.8	2000.7	3%	1940 - 2060	Passed
2500	2505.5	2508.0	2509.4	2507.6	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)
Issue date: 03-Oct-25

Approved By:
(Mr. Supot Salameh)
Field Services Section Head



Certificate of Calibration

Certificate No. C-071025-RYG_FS0111

Air Sampling Pump Detail

Equipment name: Personal Air Sampling Pump
Brand: Gilson
Model/Type: G4Air Plus
Equipment ID: RYG_FS0111
Serial No: 20150910100
Calibration Date: 07-Oct-25
Next calibration date: 07-Jan-26

Reference Standard Low Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 L
Equipment ID: RYG_FS0208
Serial No: 130027
Calibration Date: 27-Jan-25
Due Date: 26-Jan-26

Reference Standard High Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 M
Equipment ID: BKK_FS0614
Serial No: 151114
Calibration Date: 10-Sep-25
Due Date: 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	20.7	20.7	20.6	20.7	5%	19 – 21	Passed
50	51.6	51.9	51.5	51.7	5%	48 – 53	Passed
100	102.9	101.3	102.6	102.3	5%	95 – 105	Passed
200	199.8	199.9	200.5	200.1	5%	190 – 210	Passed
High Flow							
500	504.3	503.5	504.1	504.0	3%	485 – 515	Passed
1000	1001.6	1003.3	1001.8	1002.2	3%	970 – 1030	Passed
2000	2005.6	2003.8	2005.7	2005.0	3%	1940 – 2060	Passed
2500	2503.0	2508.3	2505.1	2505.5	3%	2425 – 2575	Passed

END OF REPORT

Calibrated By:
(Mr. Natchapon Thamkang)
RYG Field Services Scientist (1)
Issue date: 08-Oct-25

Approved By:
(Mr. Supot Salameh)
Field Services Section Head



Certificate of Calibration

Certificate No. C-021025-RYG_FS0739

Air Sampling Pump Detail

Equipment name: Personal Air Sampling Pump
Brand: Gilson
Model/Type: G4Air Plus
Equipment ID: RYG_FS0739
Serial No: 20241110177
Calibration Date: 02-Oct-25
Next calibration date: 02-Jan-26

Reference Standard Low Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 L
Equipment ID: RYG_FS0208
Serial No: 130027
Calibration Date: 27-Jan-25
Due Date: 26-Jan-26

Reference Standard High Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 M
Equipment ID: BKK_FS0614
Serial No: 151114
Calibration Date: 10-Sep-25
Due Date: 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.6	19.9	19.9	19.8	5%	19 - 21	Passed
50	50.9	51.1	50.8	50.9	5%	48 - 53	Passed
100	102.4	101.9	102.3	102.2	5%	95 - 105	Passed
200	200.4	203.3	201.4	201.7	5%	190 - 210	Passed
High Flow							
500	501.6	500.7	499.2	500.5	3%	485 - 515	Passed
1000	1002.2	1001.9	1005.3	1003.1	3%	970 - 1030	Passed
2000	2002.9	1999.8	2004.3	2002.3	3%	1940 - 2060	Passed
2500	2509.8	2504.2	2505.4	2506.5	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By:
(Mr. Nantawat Sarin)
RYG Field Services Scientist (1)
Issue date: 03-Oct-25

Approved By:
(Mr. Supot Salameh)
Field Services Section Head



Certificate of Calibration

Certificate No. C-071025-RYG_FS0165

Air Sampling Pump Detail

Equipment name: Personal Air Sampling Pump
Brand: Gilson
Model/Type: G4Air Plus
Equipment ID: RYG_FS0165
Serial No: 20150910037
Calibration Date: 07-Oct-25
Next calibration date: 07-Jan-26

Reference Standard Low Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 L
Equipment ID: RYG_FS0208
Serial No: 130027
Calibration Date: 27-Jan-25
Due Date: 26-Jan-26

Reference Standard High Flow Meter

Equipment name: Air Flow Meter
Brand: Mesalabs
Model/Type: Defender 510 M
Equipment ID: BKK_FS0614
Serial No: 151114
Calibration Date: 10-Sep-25
Due Date: 09-Sep-26

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/ Fail)
	1	2	3				
Low Flow							
20	19.6	19.9	20.1	19.9	5%	19 – 21	Passed
50	49.4	50.3	50.1	49.9	5%	48 – 53	Passed
100	99.6	100.1	99.8	99.8	5%	95 – 105	Passed
200	200.5	200.3	200.7	200.5	5%	190 – 210	Passed
High Flow							
500	501.8	500.2	499.8	500.6	3%	485 – 515	Passed
1000	1003.9	1001.0	1009.7	1004.9	3%	970 – 1030	Passed
2000	2001.2	2000.8	2004.2	2002.1	3%	1940 – 2060	Passed
2500	2504.4	2509.7	2505.8	2506.6	3%	2425 – 2575	Passed

END OF REPORT

Calibrated By:
(Mr. Natchapon Thamkang)
RYG Field Services Scientist (1)
Issue date: 08-Oct-25

Approved By:
(Mr. Supot Salameh)
Field Services Section Head

REVIEW BY *Thantorn N.*
APPROVED BY *KL AL*
NEXT CAL. DATE *21 Nov 25*



Bara Scientific

Certificate of Calibration

Shimadzu LC-HIC

This certificate is to verify that instrument below are calibrated

by Bara Scientific Co., Ltd

Instrument	Serial No.
DGU-403	L22166050657
SIL-20AC	L20176012374
CTD-40S	L22236003442
LC-20ADSP	L20106096217
SPD-40	L22256002616
CDD-10Avp	C21346004484
CBM-40lite	L22126103139

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: *Thawat* Date: 21 November 2024

(Mr.Thawatthai Toros)

Service Engineer



Bara Scientific Co., Ltd.
11 Chu Liny Building Floor 7, 108 Rama 4 Road, Silom Bangrak Bangkok 10500
Thailand Tel: 02-6324300 (ext.20 line) Fax: 02-6325486-2 www.barascientific.com

mg001511 3 Bara 2503

FM-05-13 Rev.01

SARTORIUS



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0006

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE125P-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SCP-WI 08.
Serial / QM Ident. no.	33108993 / RYG_EN0004	This certificate relate and apply this agreement only.
Customer	ALO Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	816/10 Moo 5 T Maenam Khu, A-Pluak Daeng, Rayong 21140, Thailand	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Thantorn N.*
APPROVED BY *KL AL*
NEXT CAL. DATE *20/02/26*

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		<i>Chonchai</i>	<i>Kachen</i>
		Mr. Chonchai Inthana	Kachen Laee

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

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Calibration certificate No.: 25BKL0006

Calibration Certificate

Calibration object

Multi interval instrument

Model	MSE125P-100-DU
Serial Number	33108993
QM Ident. no / Inventory no.	RYG_EN0004 / ---
Range	1 2
Maximum capacity (Max. load)	60.00000 g 120.0000 g
Measured range	60.00000 g 120.0000 g
Scale interval	0.00001 g 0.0001 g

Place of calibration

Address	According to page 1
Department / Cost center	Laboratory Department, ---
Building / Floor	--- / 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18. V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

Calibration certificate No.: 25BKL0006

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration Temp. diff.	24.2 °C 0.3 K
Twilights - T _{place}	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 62.5 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 50 g 100 g	Test load (nominal): 50 g
50 g 100 g	Center 50.00002 g
1 50.00002 g 100.00000 g	Front left 50.00000 g
2 50.00001 g 100.00000 g	Back left 50.00000 g
3 50.00003 g 100.00000 g	Back right 50.00001 g
4 50.00002 g 100.00000 g	Front right 50.00003 g
5 50.00001 g 100.00000 g	Maximum deviation from centric loading indication
6 50.00002 g 99.99999 g	Δ _{load} max = 0.00002 g
7 50.00002 g 100.00000 g	
8 50.00001 g 100.00000 g	
9 50.00001 g 100.00000 g	
10 50.00002 g 100.00000 g	
s = 0.000007 g s = 0.00003 g	

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0.01000 g	0.01000 g	0.00000 g	2.00	0.000024 g	0.24 %
0.10000 g	0.10000 g	0.00000 g	2.00	0.000037 g	0.037 %
1.00000 g	1.00000 g	0.00000 g	2.00	0.000037 g	0.0037 %
5.00002 g	5.00002 g	0.00000 g	2.00	0.000050 g	0.0010 %
20.00002 g	20.00002 g	0.00000 g	2.00	0.000069 g	0.00034 %
55.00004 g	55.00003 g	-0.00001 g	2.00	0.00017 g	0.00031 %
70.00000 g	70.00000 g	0.00000 g	2.00	0.00017 g	0.00024 %
80.0001 g	80.0001 g	0.00000 g	2.00	0.00018 g	0.00023 %
100.0000 g	100.0000 g	0.00000 g	2.00	0.00017 g	0.00017 %
110.0000 g	110.0000 g	0.00000 g	2.00	0.00028 g	0.00025 %
120.0000 g	119.9999 g	-0.0001 g	2.00	0.00028 g	0.00023 %
Maximum error of indication		E _{max} = 0.00010 g			

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated at the standard uncertainty of measurement multiplied by the documented expansion factor, determined in accordance with the European Calibration Guidelines EURAMET cg 18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

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10310 Bangkok

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Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

1 · 10⁻⁶/KUncertainty of the weighing result $U_0(W)$

Partial weighing range 1 | 0.00000 g...60.00000 g

 $U_0(W) = 0.000016 \text{ g} + 6.61 \cdot 10^{-6} \cdot R$

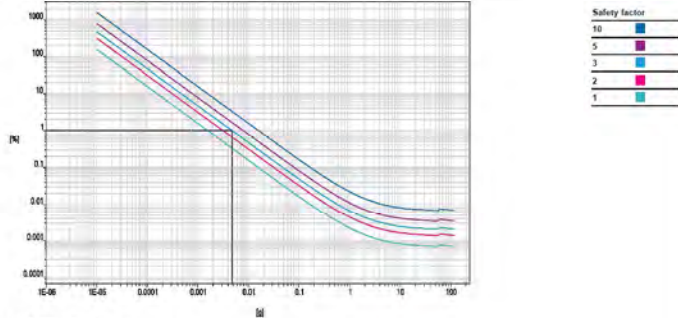
Partial weighing range 2 | 60.00000 g...120.00000 g

 $U_0(W) = 0.000086 \text{ g} + 6.19 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from Max1	Net indication R	Uncertainty $U_0(W)$	Uncertainty relative $U_0(W)/R$
1 %	0.60000 g	0.000020 g	0.0033 %
25 %	15.00000 g	0.00012 g	0.00077 %
50 %	30.00000 g	0.00021 g	0.00071 %
75 %	45.00000 g	0.00031 g	0.00070 %
100 %	60.00000 g	0.00041 g	0.00069 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy

1.00 %

Safety factor

3

Minimum sample weight

0.00474 g

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

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Agilent Technologies (Thailand) Limited
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Bangkok 10500 Thailand

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Email: ccc.smt@agilent.com
Website: www.agilent.com/thai

Customer Contact:

ALS Laboratory Group (Thailand) Co.
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwang Phatthanakan Khet Suan

TAX ID: 0105549004059

Chanattagarnimchom@alsglobal.com

27803658

Invoice To:

ALS Laboratory Group (Thailand) Co.
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwang Phatthanakan Khet Suan

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6005676091	Service Confirmation: 6905876103

REVIEW BY: *Prongphen C.*
APPROVED BY: *Sunthorn K.*
NEXT CAL DATE: 29 Mar 2025

Delivery Site:

ALS Laboratory Group (Thailand) Co.
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwang Phatthanakan Khet Suan

Location:

Room:
Bldg:
Lab:
Dept:

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc.smt@agilent.com
Contact Telephone: +662 537 8363
Contact Fax: +662 532 4334

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Agilent Technologies (Thailand) Limited Head Office
11 Chu Liang Bldg 22/F Unit A.3
909 Rama 1 Road, Silom, Bangkok
Bangkok 10500 Thailand
Tel ID: 6105549004059

Orinburi, Bangkok Branch
398 Interchange 21 Building, Sukhumvit Road, Klongtoey New
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4852-687
118 Kwang Thai Bank PCL
Siam Square Bldg A16/11 S (Rama) Rd, Pathumwan, BKK 10330
Thailand

ORIGINAL

Page 1 of 3

Service Confirmation Number: 6905876103
Service Confirmation Date: 23.09.2024

Service Confirmation Number: 6905876103
Service Confirmation Date: 23.09.2024

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IO-5100	ICP-OES 5100/5110 System			
G8010A	Agilent 5100 SVDV ICP-OES Spectrometer	MY16010005	ICP OES 5100	SYS-IO-5100
G8410A	SPS 4 Autosampler	AU15440764	ICP OES 5100	SYS-IO-5100

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	E00	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	22.09.2024	23.09.2024
1010	6610030100	Bottle ICP-OES Wavecal soln 500mL 5 ppm	1.00	Agreement Entitlement 100 % covered		
1020	5196-7001	Calibration blank solution 5pct HNO3	1.00	Agreement Entitlement 100 % covered		

Additional Information:

Service Information:

Problem Description:
WU-DQ-10-5100-5001253655

Service Provided:
Complete OQHW 5100/CPQES
Equipment ID: BKK_EL0037, all test passed

Service Overview Code:
Reason Code: Scheduled Service
Diagnosis Code: Scheduled Service
Resolution Code: Scheduled Service

Reported Hours: 4.0	Travel Hours: 2.0
Customer Field Service Representative Name: Suvann Onkhon	Customer Field Service Representative Signature: <i>Suvann O.</i>
Customer Name: CHANATTAGARN IMCHOM	Customer Signature: <i>Prongphen C.</i>
Date: 23 Sep 2024	

Additional Comments:



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9489



Certificate of Calibration

Certificate No.: 25PH134
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: TENMARS
Model: TM-201L
Serial No.: 20030974
ID No.: RYG_FS0474
Condition As-Received: Used Item
Received Date: 05 March 2025
Calibration Date: 13 March 2025
Reference: 2503-0138WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (59 ± 15) %
Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Procedure used: Calibration were conducted using calibration procedure No. CP-PH01 based on inverse square law technique.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encoder	LMgrade 9.6 m	120RC003	DL-0064-22	20 Jul 2025
2) STANDARD LAMP	OL FEL-U	F-1765	TP-1009-24	17 May 2025

2. This result of calibration was made on requested at the point specified by customer.

3. Test Equipment: Programmable Voltage/Current Source (Model: OL83A, SN: 16221394)

4. Test Equipment: Illuminance Meter (Model: 51002, SN: 080129)

5. The certificate is valid only to the item calibrated on date and place of calibration.

6. This Certification is traceable to the International System of Unit maintained through:-

- National Institute of Metrology Thailand (NIMT)

- National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

REVIEW BY: S.T.S.
APPROVED BY: [Signature]
NEXT CAL DATE: 12/03/2026

Calibrated by: Nivat Nitas
Issue Date: 14 March 2025

Approved Signatory:
[] Phalinee Pratsapal
[] Chatchawan Khunpluek
[x] Nuntawat Khanchai



Cert. No.: 25PH134
Page: 2 of 2

Result of calibration:		(*) Without adjustment	() After adjustment		
Function:	Illuminance Measurement	Range:	200 lx		
	Standard Value	UUC* Reading	Error	Uncertainty	
	(lx)	(lx)	(lx)	(± lx)	
	0	0.5	0.5	-	
	20	19.9	-0.2	0.26	
	50	50.0	0.0	0.65	
	100	100.4	0.4	1.3	
	150	150.6	0.6	2.0	
	190	190.7	0.7	2.5	
Function:	Illuminance Measurement	Range:	2000 lx		
	Standard Value	UUC* Reading	Error	Uncertainty	
	(lx)	(lx)	(lx)	(± lx)	
	200	199	-1	2.6	
	500	499	-1	6.5	
	1000	1000	0	13	
	1500	1501	1	20	
	1900	1903	3	25	
Function:	Illuminance Measurement	Range:	20000 lx		
	Standard Value	UUC* Reading	Error	Uncertainty	
	(lx)	(lx)	(lx)	(± lx)	
	2000	1990	-10	26	
	3000	3000	0	39	
	4000	4010	10	52	
	5000	5030	30	65	

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %

UUC* = Unit Under Calibration.

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JIRANATEE ASSOCIATES CO., LTD.
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8/214 15, 4/730-36
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E-mail: jrac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
NSC-TIS 17025:2017
NSC-TIS 17025
CALIBRATION 0367
Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No.: COT-138-68

Page 1 of 2 Pages

MEASUREMENT ITEM: Heat Stress Monitor
MANUFACTURER: Delta OHM
MODEL/TYPE: HD32.2
SERIAL NUMBER: 22016388
ID NUMBER: RYG_FS0578
CONDITION AS-RECEIVED: Used Item
CUSTOMER: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE: 05 Aug 2025
MEASUREMENT DATE: 13 Aug 2025
ISSUE DATE: 14 Aug 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

REVIEW BY: S.T.S.
APPROVED BY: [Signature]
NEXT CAL DATE: 12/08/2026

Calibration procedure:

The temperature calibration was done by in-house calibration method as W-CI-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-1013-25, Certificate number: ER-0051-25.

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 867682-09,
Due date: 9 Apr 2026
2. Digital Temperature Indicator
Model: DTI-1000 A MK II, Serial No.: 671407-
00591 Due date: 22 Apr 2026

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

Calibrated by:
[x] Mr. Sorawit Thachalad
[x] Miss Jitraporn Lertsomphol
[x] Miss Ruangrumpal Phoommit



Approved signatory: Mr. Paitanya Booncharoen
Calibration Department Manager



Continuation of Certificate of Calibration Number CDT-138-68
Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 10 °C to 50 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22015694.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	10.051	9.9	-0.2	0.099
80	20.051	19.9	-0.2	0.099
80	30.018	29.8	-0.2	0.099
80	40.004	39.8	-0.2	0.099
80	49.992	49.8	-0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22023956.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	10.051	10.1	0.0	0.099
110	20.051	20.1	0.0	0.099
110	30.018	30.1	0.1	0.099
110	40.004	40.0	0.0	0.099
110	49.992	50.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 22025031.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	10.051	10.5	0.4	0.099
75	20.050	20.1	0.0	0.099
75	30.018	29.9	-0.1	0.099
75	40.004	39.7	-0.3	0.099
75	49.992	49.5	-0.5	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-140-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 22016390
ID NUMBER : RYG_F50580
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 05 Aug 2025
MEASUREMENT DATE : 14 Aug 2025
ISSUE DATE : 14 Aug 2025

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:
The table on next page give the measured values.

REVIEW BY: *Spt S*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 13/ 08/ 2026



Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpal Phoommit

Approved signatory: *[Signature]*
Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Calibration procedure:
The temperature calibration was done by in-house calibration method as WJ-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-1013-25. Certificate number: ER-0061-25.

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 9 Apr 2026
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671497-00591 Due date: 22 Apr 2026

Uncertainty of Measurement:
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement

Continuation of Certificate of Calibration Number CDT-140-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 10 °C to 50 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22025580.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	10.044	10.0	0.0	0.099
80	20.052	20.0	-0.1	0.099
80	30.022	29.9	-0.1	0.099
80	39.997	39.9	-0.1	0.099
80	49.993	49.8	-0.2	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22023942.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	10.044	10.1	0.1	0.099
110	20.052	20.1	0.0	0.099
110	30.022	30.0	0.0	0.099
110	39.997	40.0	0.0	0.099
110	49.993	50.0	0.0	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 22025040.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	10.044	10.4	0.4	0.099
75	20.052	20.1	0.0	0.099
75	30.022	29.9	-0.1	0.099
75	39.997	39.7	-0.3	0.099
75	49.993	49.6	-0.4	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-141-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Heat Stress Monitor
MANUFACTURER : Delta OHM
MODEL/TYPE : HD32.2
SERIAL NUMBER : 22016391
ID NUMBER : RYG_F50581
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 05 Aug 2025
MEASUREMENT DATE : 14 Aug 2025
ISSUE DATE : 14 Aug 2025

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:
The table on next page give the measured values.

REVIEW BY: *Spt S*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 13/ 08/ 2026



Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpal Phoommit

Approved signatory: *[Signature]*
Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Calibration procedure:
The temperature calibration was done by in-house calibration method as WJ-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-1013-25. Certificate number: ER-0061-25.

Reference Used During Calibration:
1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 9 Apr 2026
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671497-00591 Due date: 22 Apr 2026

Uncertainty of Measurement:
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM Evaluation of measurement data - Guide to the expression of uncertainty in measurement

Continuation of Certificate of Calibration Number CDT-141-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 10 °C to 50 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2, S/N: 22025583.
Dimension: Diameter 3.3 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
80	10.044	9.9	-0.1	0.099
80	20.053	19.9	-0.2	0.099
80	30.023	29.8	-0.2	0.099
80	39.997	39.7	-0.3	0.099
80	49.992	49.7	-0.3	0.099

Table 2: This equipment was connected with Globe thermometer probe Model: TP3276.2, S/N: 22023943.
Dimension: Diameter 3.3 mm. Length 205 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	10.044	10.1	0.1	0.099
110	20.053	20.0	-0.1	0.099
110	30.023	30.0	0.0	0.099
110	39.997	40.0	0.0	0.099
110	49.992	49.9	-0.1	0.099

Table 3: This equipment was connected with temperature probe Model: TP3207.2, S/N: 22025054.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
75	10.044	10.5	0.5	0.099
75	20.053	20.0	-0.1	0.099
75	30.023	29.7	-0.3	0.099
75	39.997	39.6	-0.4	0.099
75	49.992	49.5	-0.5	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration





Certificate of Calibration

Cert.No.: 25CH709/1
Page.: 1 of 3

This Certificate was issued to replace the Certificate No.25CH709

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 12 June 2025
Calibration Date : 18 June 2025
Reference : 2500-0407DSC-2
Submitted by : **ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand**

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirirthean

Approved by :
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Palpim
(✓) Saithip Meangmai

Issue Date : 1 July 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd., Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(mV)	k
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Certificate of Calibration

Certificate No.: 25E1978/1
Page : 1 of 2

This Certificate was issued to replace the Certificate No. 25E1979

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152

Condition As-Received: Used Item
Received Date : 12 June 2025
Calibration Date : 16 June 2025

Reference : 2506-0407DSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 10) %

Submitted by : **ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch**

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**616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand**

Procedure used : Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	5500A	6315011	25E1627	19 May 2026

2.This result of calibration was made on requested at the point specified by customer.

3.The certificate is valid only to the item calibrated on date and place of calibration.

4.This measurement result is traceable to the International System of Unit maintained through:-

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Wutchareeporn Peethong
Issue Date : 01 July 2025

Approved Signatory :
() Phalinee Prabpaipal
(✓) Nuntawat Khamchai
() Pongsagorn Boonyaporn



Cert. No.: 25E1979/1
Page.: 2 of 2

Result of calibration :- (*) Without adjustment () After adjustment

Function: DC voltage measurement

Standard Value	UUC* Reading	Range	Error	Uncertainty
(mV)	(mV)	2000 mV	(mV)	(± µV)
-200.0000	-199.9		0.1	68
-150.0000	-150.0		0.0	65
-100.0000	-100.0		0.0	63
-50.0000	-50.0		0.0	61
0.0000	0.0		0.0	58
50.0000	50.0		0.0	61
100.0000	100.0		0.0	63
150.0000	149.9		-0.1	65
200.0000	199.9		-0.1	68

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %

UUC* = Unit Under Calibration.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2717-3000-29 FAX 0-2719-9484



Certificate of Calibration

Cert. No.: 25LM10
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,
Rayong 21140 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025
Calibrated Date : 20 January 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lemgagrakul

Approved by :

() Chakrit Waewwanjua
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 23 January 2025

The Uncertainties are for a confidence probability of approximately 95%

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REVIEW BY	Photchanas
APPROVED BY	<i>D. Pongpan</i>
NEXT CAL DATE	20/07/26



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2501-0600DSC-2

Cert. No.: 25LM10
Page.: 2 of 2

Procedure Used :- Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	24/1022	TPA	17 Sep 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 15E100464

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.002	19.81	-0.192	0.15	2.00

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-000-



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2717-3000 FAX 0-2719-9484

Certificate of Testing

Cert.No.: 25TW15
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 17 January 2025
Test Date : 20 January 2025
Reference : 2501-0600DSC-1

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Plukdaeng,
Rayong 21140, Thailand

Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirthean

Approved by :

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 January 2025

Saithip
Approved Signatory



Cert.No.: 25TW15
Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :
This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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Certificate of Calibration

Cert. No.: 24TM1663
Page : 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG_EN0154

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd. Rayong Branch
616/10 Moo 5, T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140, Thailand

Location : BOD Room

Received Order : 01 November 2024

Calibration Date : 01 November 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by :

Krisda Malee

Approved by :

Kunchit

Approved Signatory

- () Ponpan Palpim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Procedure Used :-

Cert. No.: 24TM1663
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD). The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

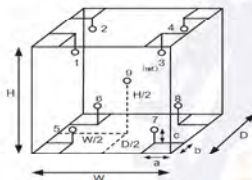
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	25
REL.Humid. (%)	55	53
AC Supply (Volt)	220	221



Probe Installation Details :

Dimension of Chamber :

a = 10 cm	D = 0.80 m
b = 10 cm	W = 1.0 m
c = 10 cm	H = 1.2 m
	Capacity = 0.72 m³

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM1663
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-00-



Certificate of Calibration

Cert.No.: 24CG3711
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng
Rayong 21140, Thailand
Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 756 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Sa-ngeunkam Wongsu
Approved by :
(✓) Srisuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai
Issue Date : 24 September 2024

REVIEW BY *Thanitak*
APPROVED BY *D. Khamtha*
NEXT CAL DATE 24/09/25

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594582	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0259	0.0082	2.00
20	20.0214	0.0085	2.00
30	30.0006	0.0089	2.00
40	40.0003	0.0094	2.00
50	49.9988	0.011	2.00

Remark mL = cm³

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o-o-



Certificate of Calibration

Cert.No.: 25CG3668
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : RYG_EN0216
Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5 T.MaenamKoo, A.Pluakdaeng
Rayong 21140, Thailand
Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 753 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Srisuda Khamtha
Approved by :
() Ponpan Paipim
(✓) Chakrit Waewwanjua
Issue Date : 19 September 2025

REVIEW BY *Thanitak*
APPROVED BY *D. Khamtha*
NEXT CAL DATE 18/09/26

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Burette
Received Date : 16 September 2025
Condition As-Received : Used Item
Calibration Date : 18 September 2025
Reference : 2509-0564DSC-3

Cert.No.: 25CG3668
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	25MM296	TPA	16 July 2026
2) Humidity/Baro/Temp	MHB-382SD	AM.42259	140EC016	25H1616	TPA	14 Aug 2026
3) Digital Thermometer	HH376	230806555	140EC013	25H1740	TPA	17 Jan 2026

This measurement result is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	10.0264	0.0082	2.00
25	25.0141	0.0087	2.00
50	49.9952	0.010	2.00

Remark mL = cm³

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, providing a level of confidence of approximately 95 %.

-o-o-



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature 24.4 °C ± 0.3 °C
Humidity 60.8 %RH ± 3.5 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-W-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

APPROVED BY
NEXT CAL. DATE 18/03/26

(Mr. Preecha Phooarsai)
Person in charge

(Miss Kaewkan Suradach)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) is provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The record shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C06-16; 11 Mar 2024



Certificate No.: C06250108 Page 2 of 3

Calibration Results: Without Adjustment

Wavelength Accuracy (nm), The spectral Bandwidth of Std at 2 nm and UUC at 2 nm				
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty	
418.61	418.5	0.11	0.13	
536.68	536.7	-0.04	0.13	
637.88	638.3	-0.32	0.13	
746.48	748.6	-0.32	0.13	
807.03	807.5	-0.47	0.13	

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.008	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2916	0.290	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9488	0.946	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

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CAL-FM-C06-16; 11 Mar 2024



Certificate No.: C06250108 Page 3 of 3

Calibration Results: Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7365	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
358 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080
Stray light *				
Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)	
260.62 +/- 0.11 nm	260.6	1.7	1.779	
391.44 +/- 0.11 nm	391.4	1.4	1.854	
Spectral Resolution *				
Nominal Concentration 0.02 % w/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4566	0.2780		
UUC: Absorbance (A)	0.413	0.299		

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate

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CAL-FM-C06-16; 11 Mar 2024



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: DR6000 หมายเลขเครื่อง: 1627845

ตรวจรอบ (วัน)		รายการตรวจเช็ค	ตรวจรอบ (ครั้ง)		หมายเหตุ
18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. ความสมบูรณ์เครื่อง	☒	☐	
☒	☐	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	☒	☐	
☒	☐	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	☒	☐	
☒	☐	4. ปุ่มกด (Keypad)	☒	☐	
☒	☐	5. หน้าจอ (Display, Screen Contrast)	☒	☐	
		Spectrophotometer			
☐	☐	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	☐	☐	
☐	☐	7. กำหนดเลือกความยาวคลื่น (Wavelength Control)	☐	☐	
☒	☐	8. ความยาวคลื่น (Wavelength Check)	☐	☐	
☒	☐	9. แสงกำเนิดแสง (UV < 3,000 hour)	☒	☐	13.5 Hours
☒	☐	10. แสงกำเนิดแสง (Visible < 5,000 hour)	☒	☐	893.0 Hours
☒	☐	11. ช่อดักหลวยตัวอย่าง (Carousel Module)	☒	☐	
		pH Meter and Conductivity Meter			
☐	☐	12. อิเล็กโทรด (Electrode and Connection Cable)	☐	☐	
☐	☐	13. ระดับสารละลายใน Electrode (Level KCl)	☐	☐	
☐	☐	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	☐	☐	
☐	☐	15. ขาจับอิเล็กโทรด (Stand)	☐	☐	
		Turbidimeter			
☐	☐	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	☐	☐	
☐	☐	17. ระดับการรบกวนจากแสง (>= 2.5 ไม่นาน 3.0)	☐	☐	
		Automatic titrator			
☐	☐	18. สภาวะ Piston Bursties	☐	☐	
☐	☐	19. Function Rinsing and Dosing	☐	☐	
☐	☐	20. ระบบจ่ายยาและอุปกรณ์ประกอบ	☐	☐	

เพี้ยนเป็นค่าเฉลี่ย: * 656.1nm = 656.1nm
* 486.0nm = 485.7nm

Mr.Preecha Phooarsai
Service Engineer

DKSH Technology Limited
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CAL-FM-R31-03; 20 Jul 2022



Accredited by

NSC-TIS-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0002

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards. Uncertainties of measurements are taken into account when only statements of compliance are made.
Manufacturer	Sartorius	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Mikrod) SOP W108.
Type	MCE224S-2500-U	This certificate relates and apply this equipment only.
Serial QM Ident. no.	38101399 RYG_EN0163	
Customer	ALG Laboratory Group (Thailand) Co., Ltd. (Rayong Branch)	
	816/10 Moo 5 T.Mae Nam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY *Thanitak*
APPROVED BY *Dharmaraj*
NEXT CAL DATE: 20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TIS-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		<i>Chonchai</i>	<i>Kachen</i>
		Mr. Chonchai Inthana	Kachen Laee

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129 Rama 9 Road, Huaykwang
10310 BangkokVerical®
Version 6.5

Page 1 | 4

Calibration certificate No.: 25BKL0002

Calibration Certificate

Calibration object

Single range instrument

Model	MCE224S-2500-U
Serial Number	38101399
QM Ident. no Inventory no.	RYG_EN0163 --

Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Laboratory Department --
Building Floor	-- 1st Floor.
Room	Balance Room.
Maximum temperature variation at place of calibration	5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHS-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

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10310 BangkokVerical®
Version 6.5

Page 2 | 4

Calibration certificate No.: 25BKL0002

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration	20 Feb 2025
Temperature at place of calibration Temp. diff.	24.4 °C 0.6 K
Twilight - Time	
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 58.0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g 200 g	Test load (nominal): 100 g
10 g	200 g
1	10.0000 g
2	10.0000 g
3	10.0000 g
4	9.9999 g
5	9.9999 g
6	10.0000 g
7	10.0000 g
8	10.0000 g
9	9.9999 g
10	10.0000 g
$s = 0.00005$ g	$s = 0.00005$ g

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
10.0000 g	9.9999 g	-0.0001 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0001 g	0.0001 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0000 g	0.0000 g	2.00	0.00016 g	0.00016 %
200.0000 g	200.0000 g	0.0000 g	2.00	0.00026 g	0.00014 %
220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %
Maximum error of indication		$E_{\max} = 0.0001$ g			

$U_{95}(E)$ is the quantile of $U(E)$ and test load L . The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under Appendix to the calibration certificate. Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented expansion factor, determined in accordance with the European Calibration Guidelines EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measured will be in the assigned value range.

End of calibration certificate

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Interpretation of measurement results | Appendix to the calibration certificate

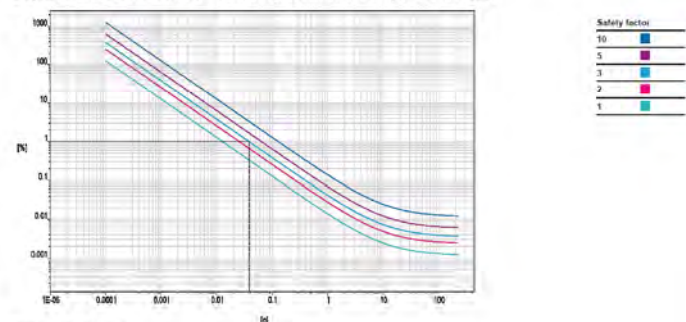
Uncertainty of measurement in use

Device adjusted before measurement	Yes
Temperature deviation considered	1.5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁴ /K
Uncertainty of the weighing result $U_g(W)$	$U_g(W) = 0.00013$ g + $1.16 \cdot 10^{-4} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering the reading R into the formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor of 2, determined in accordance with the European Calibration Guidelines EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measured will be in the assigned value range.

Indication in % from max load	Net indication	Uncertainty	Uncertainty relative
1 %	2.2000 g	0.00016 g	0.0071 %
25 %	55.0000 g	0.00077 g	0.0014 %
50 %	110.0000 g	0.0014 g	0.0013 %
75 %	165.0000 g	0.0020 g	0.0012 %
100 %	220.0000 g	0.0027 g	0.0012 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0381 g

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Certificate No. T251530

Certificate of Calibration

Page 1 of 3

Equipment : Chamber (Oven)
Manufacturer : MEMMERT
Model : UF 110
Serial No. : B416.2420
Customer Code : RYG_EN0012
ID No. : T6444A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenamkoo,
A.Pluakdaeng, Rayong 21140
Customer Location : ENVIRONMENT LABORATORY
Date of Receipt : 3 September 2025
Calibrated By : Sujjar Nakkakred (Site Calibration Manager)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 17 SEP 2025



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology Center.

FM-TL06 102/27-03-68



Certificate No. T251530

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 10 September 2025
Environment : Temperature : 35.7-36.6 °C
Line Voltage : 226.8-233.7 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	30-(CH1-10)	T242203	9 November 2025
DATA LOGGER	34970A	T47	T242203	9 November 2025
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.
- Condition of calibrated item : good
Equipment Description :
Time Constant 3 Hour 29 Minute At 104 °C
Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available
- Adjustment :
() without adjustment (X) after adjustment

Approved By: Boonchai Suriyawong

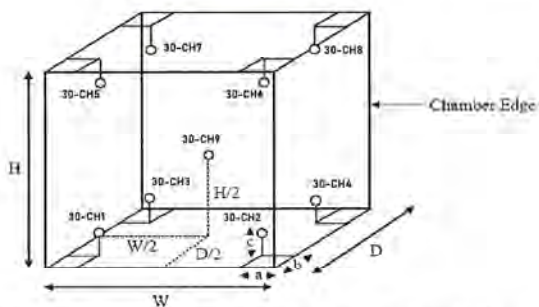
FM-TL07 102/27-03-68



Certificate No. T251530

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm , H (Height) = 48 cm and D (Depth) = 40 cm.
Size of installed Standard sensor number 30-CH1 to number 30-CH8 : ± 5 cm , ± 5 cm , and ± 5 cm.
Size of installed Standard sensor number 30-CH9 : W/2 = 56 cm /2 , H/2 = 48 cm /2 and D/2 = 40 cm /2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	30-CH1	30-CH2	30-CH3	30-CH4	30-CH5	30-CH6	30-CH7	30-CH8	30-CH9
104	104.02	103.70	104.01	104.16	104.11	104.08	104.01	104.33	103.61
180	180.67	178.78	180.38	179.85	179.16	180.27	180.98	181.04	179.49

Chamber (Oven)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
104.0	103.9 , 104.1	104.0	104.00	0.08	0.61	0.42	2.00
180.0	179.9 , 180.1	180.0	180.07	0.21	1.51	0.52	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on data and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a normal distribution, providing

a level of confidence of approximately 95 %.

End of Certificate.

Approved By: Boonchai Suriyawong

FM-TL07 102/27-03-68

SARTORIUS



Accredited by

NSC-TISI-TIS 17025
Calibration 0425

Calibration certificate

Calibration Certificate No. 25BKL0003

Object : Electronic non-automatic weighing instrument
Manufacturer : Sartorius
Type : MSU224S-100-DU
Serial / OM Ident. no. : 31709552 | RYG_EN0003
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng Rayong 21140, Thailand.
Order no. : 2230
Number of pages : 4
Date of calibration : 20 Feb 2025



This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.
The user is obliged to have the object recalibrated at appropriate intervals.

Date : 06 Mar 2025
Approval of the Calibration Certificate : Chonchai Inthana
Person in charge : Kachen Lalee

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129 Rama 9 Road, Huaykwang
10310 Bangkok

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Calibration object

Single range instrument

Model MSU224S-100-DU
Serial Number 31709552
QM Ident. no | Inventory no. RYG_EN0003 | —

Maximum capacity (Max. load) 220.0000 g
Measured range 220.0000 g
Scale interval 0.0001 g

Place of calibration

Address According to page 1
Department | Cost center Laboratory Department. | —
Building | Floor — | 1st Floor.
Room Balance Room.
Maximum temperature variation at place of calibration 5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type	Test equipment ID	Valid until
Thermometer	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S_E2(Traceable to SI unit through TCS)	23 Aug 2025

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration 20 Feb 2025
Temperature at place of calibration | Temp. diff. 24.7 °C | 0.3 K
Twilights - Tplace
Measuring conditions The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments Humidity 62.3 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity
Test load (nominal): 10 g 200 g	Test load (nominal): 100 g
10 g 200 g	Center 100.0000 g
1 10.0000 g 200.0000 g	Front left 100.0000 g
2 10.0000 g 200.0001 g	Back left 100.0001 g
3 9.9999 g 200.0000 g	Back right 99.9999 g
4 10.0000 g 200.0000 g	Front right 99.9999 g
5 10.0000 g 200.0001 g	Maximum deviation from center, loading indication
6 9.9999 g 200.0000 g	Δecc max = 0.0001 g
7 10.0000 g 200.0000 g	
8 10.0000 g 200.0000 g	
9 10.0000 g 200.0000 g	
10 10.0000 g 200.0001 g	
s = 0.00004 g s = 0.00005 g	

Error of indication	Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
	L	I	E	K	U(E)	U _{rel} (E)
	0.0100 g	0.0100 g	0.0000 g	2.00	0.00012 g	1.2 %
	0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %
	0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %
	1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %
	5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %
	10.0000 g	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
	20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
	50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
	100.0000 g	100.0001 g	0.0001 g	2.00	0.00018 g	0.00018 %
	200.0000 g	200.0000 g	0.0000 g	2.00	0.00028 g	0.00014 %
	220.0000 g	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %
Maximum error of indication			E _{max} = 0.0001 g			

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under Appendix to the calibration certificate. Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Interpretation of measurement results | Appendix to the calibration certificate

Uncertainty of measurement in use

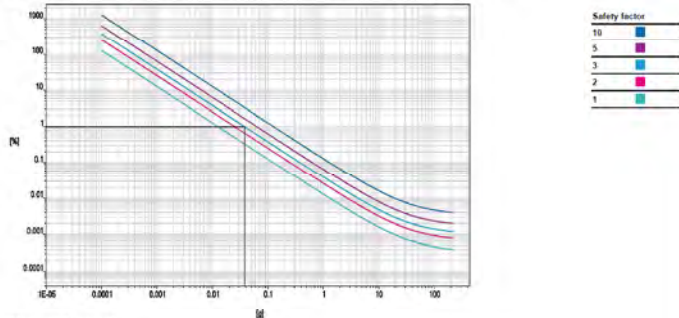
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered 1 · 10⁻⁴/K

Uncertainty of the weighing result U₉₅(W) U₉₅(W) = 0.00013 g + 3.42 · 10⁻⁴ · R

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty U ₉₅ (W)	Uncertainty relative U ₉₅ (W) _{rel}
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00032 g	0.00058 %
50 %	110.0000 g	0.00051 g	0.00046 %
75 %	165.0000 g	0.00069 g	0.00042 %
100 %	220.0000 g	0.00088 g	0.00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.0380 g

Metrology
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhloi, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T242075

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Certificate of Calibration

Equipment	: Liquid Bath (Water)
Manufacturer	: Memmert
Model	: WNE29
Serial No.	: L623.0105
Customer Code	: RYG_EN0220
ID No.	: T5650A5
Customer	: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140
Customer Location	: Wet Chemistry Lab
Date of Receipt	: 11 December 2024
Calibrated By	: Atiphong Rongrat (Technician)
Approved By	: Boonchai Suriyawong (Site Calibration Manager)
Date of Issue	: 20 DEC 2024

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T242075

Page 2 of 3

Calibration Report

Equipment : Liquid Bath (Water)
Date of Calibration : 19 December 2024
Environment : Temperature : 25.3-25.9 °C
Line Voltage : 221.4-225.4 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T36 (based on ASTM E715-83 (Reapproved 2001)).
All data show below were final values and the initial data from customer request. The temperature scale used, was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 OHM	M34 (CH1-CH5)	T240400	16 March 2025
DATA LOGGER	34970A	T193	T240400	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-17025 CALIBRATION 6244)

4. Condition of calibrated item : good

Equipment Description :

Time Const. 1 Hour 30 Minute At 63 °C

5. Adjustment :

(X) without adjustment () after adjustment

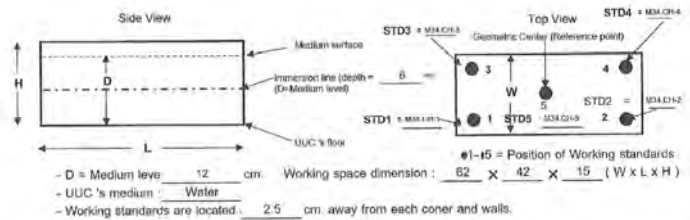
Approved By:

FM-L15 11/18-08-66

Certificate No. T242075

Page 3 of 3

Calibration Report



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	M34.CH-1	M34.CH-2	M34.CH-3	M34.CH-4	M34.CH-5
63	62.67	63.00	62.98	62.98	63.22
85	84.78	85.14	84.69	85.07	85.24

Setting (°C)	Reading (°C)		Temperature Distribution				
	Min	Max	Average (°C)	Stability (± °C)	Uniformity (± °C)	Uncertainty (± °C)	Coverage Factor k
63.0	-	63.0	62.98	0.07	0.25	0.23	2.00
85.0	-	85.0	85.02	0.13	0.35	0.28	2.00

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-L15 11/18-08-66



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 25CH1002

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenGo S2
Serial No. : C232588428
ID No. : RYG_FS0606
Condition As-Received: Used Item
Received Date : 22 August 2025
Calibration Date : 25 August 2025
Reference : 2508-0746DSC-2
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Walalak Sirthean

Approved by :

Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai

Issue Date :

26 August 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.



Cert.No.: 25CH1002
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	58440003	130RC120	24E3731	25 Nov 2025
2) Ref. Standard Thermometer	4982054	110RC044	25I708	03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.987	CPA chem	1034204	27 Sep 2025
pH 10.010	CPA chem	1114385	08 June 2026

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: C232588428	4.00	177.48	178	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.00	0.58	2.00



Cert.No.: 25CH1002

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode	4.007	4.02	130	0.0071	2.00
S/N.: 3293229	6.987	7.01	-43	0.0092	2.00
	10.010	10.01	-214	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Go-ISM

- Serial No. : 3293229

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement ($\pm$ $^{\circ}\text{C}$)	Coverage factor k
25.0	25.001	25.1	0.099	0.13	2.00
45.0	45.001	45.1	0.099	0.13	2.00

Remark : - UUC* = Unit Under Calibration

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-